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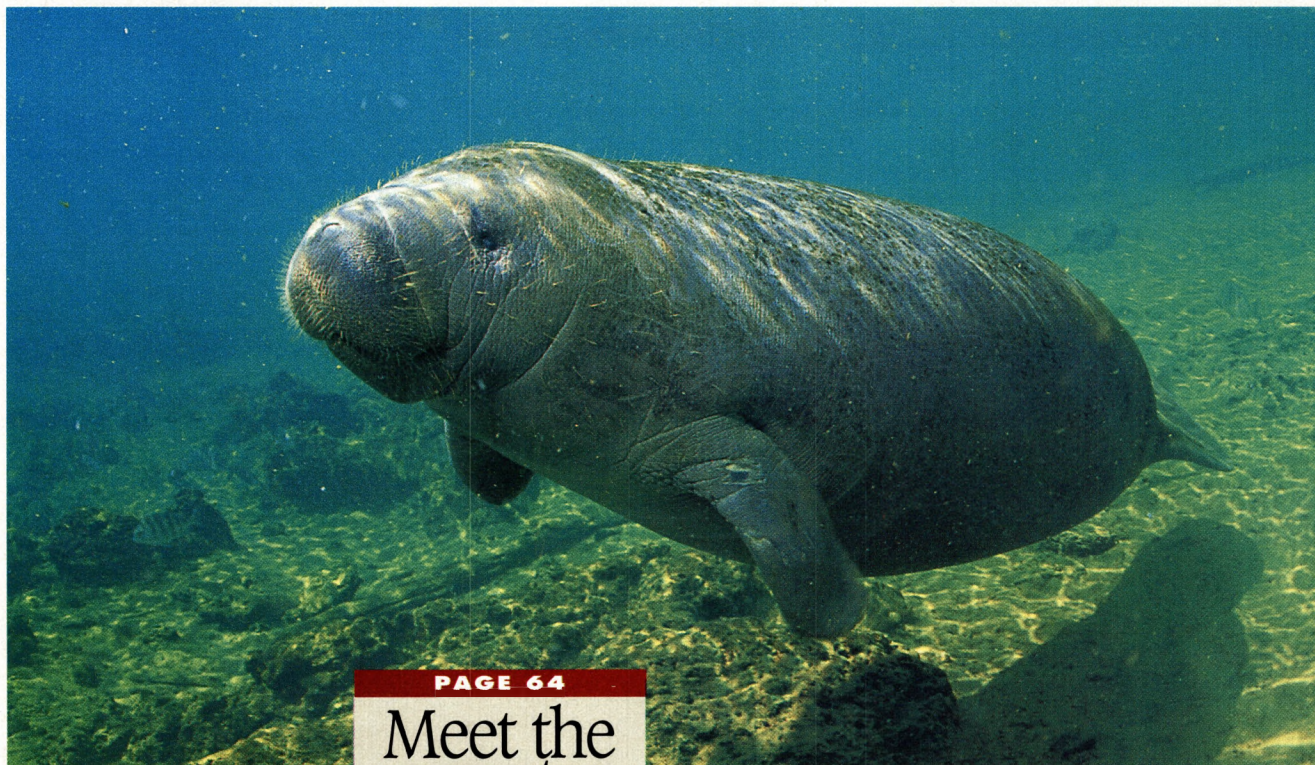


COVER: MARTY SNYDERMAN

SPORT DIVER

M A G A Z I N E

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These gentle mammals are endangered and some would like to see encounter programs become extinct.

By Vince Rhodes

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DIVE-O-LYMPICS

BY PIERCE HOOVER

Diving is one of the world's great sports. So why don't we get more respect from the prime-time sporting media? Why no Saturday Classics with Madden and Summerall commentary live from the wheelhouse?

My guess is that it's because there's no way to keep score. By its nature, diving is not a competitive sport. You do see the occasional dive nerds involved in card-counting battles over who has the most certifications, and there's the unspoken and often-denied tendency — especially among hairy-chested male divers — to compare the relative lengths of their oversized "Super Titanium" dive knives.

But for the most part, divers seem to be well-balanced individuals content to roll overboard and enjoy a private and non-ego-dependent experience. So how are we gonna get on network sports?

I think I have the answer, and the good news is that it won't even change the way we dive. Hey, we're only human, and we've all pulled a few bone-headed moves in our diving careers. But it's precisely these human foibles that are best suited for competitive scoring in an Olympics-like series of events.

"It's a beautiful Saturday morning here in Palm Beach, a great day for a Dive-O-lympic. So what's first, Pat."

"Well John, we're going to look in on the semi-finals of the Paired Buddy Spending event. This matches two dive buddies of equal credit limits in a biathlon-type course that begins with a 20 minute spending sprint, followed by a marathon explanation session to the spouse when the bills come due. The excitement's mounting and there's a smell of searing plastic as they max out those credit cards."

"Great, but now it's time to go live to Chuck at the inlet, where six-foot seas and plenty of diesel fumes make conditions perfect for the Hurling Contest. In case any of you at home are wondering, no, this type of Hurling isn't the Irish version of field hockey, but instead is scored on distance, style and recovery. Chuck,

what's today's winning strategy?"

"John, it seems that the real pros plan to go for the downwind rail, which will also earn them extra Gratitude points from the passengers."

"Umm, yeah. We'll get back to you on that one. Now let's cut to the Bungee Jumping finals. You don't need to leap off a bridge for this one, all it takes is standard scuba gear and a dive boat with elastic cords to hold the tanks in place.

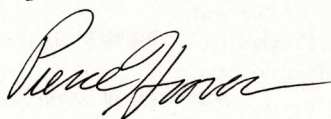
"Our competitors are assembling their gear, they're re-attaching the bungs so the tanks won't fall over, the dive master gives the signal, they cinch up, stand up and — OHH! Looks like somebody forgot to remove that little elastic cord before they stood up!

"Wow, Ka-Powie! That was some back flip Pat, but now it's time for the Co-ed Unsynchronized Swimming Demonstration. And here's our first pair now. Glen's up to 220 pounds this season, while Sally's holding even at 115. The swells are big so Glen climbs the ladder first rather than helping Sally. Oops, he slips, and now they're gonna have a hard time untangling to grab that trailing float line. I'm predicting that this team won't be together next season."

"Wow, what a day folks! And to wrap it up, let's look in on the Freestyle Backpeddling Competition at the Dockside Bar. Last year's champion is just getting into a big story on the giant clam that attacked him in the Bahamas last year when — Wham! — the marine biologist in the corner says that species isn't found in the Atlantic. Wow, let's see him backpeddle out of this one!"

"And that's all for now folks. Hope you've enjoyed today's coverage, and maybe you can even identify with a few of our competitors."

"So long, and remember: dive safe, but don't take yourself too seriously. Let's go out there and have some fun!"



SPORT
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MAGAZINE

Publisher Terry Snow

Editorial Staff

Editor Pierce Hoover

Managing Editor Vincent Rhodes

Editorial Assistant Alisa Hood

Contributing Writers

Tom Mount, Doug Perrine, Yvette Cardozo, Pat Canova, Bret Gilliam, Kathy deWet, Valerie Moore, Rick Gaffney, Norbert Wu, Tom Turner

Contributing Photographers

Doug Perrine, Norbert Wu, Marty Snyderman, Bret Gilliam, Brian Skerry, Kathy deWet, Courtney Platt, Jeannie Wiseman, Franklin Viola, C. Shelley Acuff, Amos Nachoum, Rick Gaffney, Yvette Cardozo, Judi Brooks, Mark Conlin, Kim Stanberry, Walt Stearns, F. Stuart Westmoreland, M. Timothy O'Keefe, Jesse Cancelmo, Pat Canova, Dan Shell, Arnold Jackson, Doug Dukane

Contributing Artists

David Underwood, Brenda Weaver

Art Department

Art Director David Weaver

Advertising Artist Lee Morgan

Production Coordinator Tim Jones

Production Manager Lisa Earlywine

Advertising

Advertising Director Susan S. Gilman

407-628-4802

Sales Representatives

Dawn Driggs, Donna Snow

407-628-4802

Carin Beaulieu

Florida Keys Office 305-852-7840

Advertising Coordinator Monica Walsh

Marketing Staff

Circulation Manager Sharon Gifford

Product Marketing Manager Jennifer McComb

Subscription Fulfillment Manager Jim Robinson

Market Research Manager Meei Lum

Business Staff

Vice President Dave Freygang

Manager, Accounting Kris Zadrozny

Accounts Receivable Assoc. Tami Tichy-Brooks

Credit Manager Dinah L. Peterson

Human Resource/Office Manager Boni Bruun

Image Assembly

Ewasko's Litho Services, Orlando Florida

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Sea Facts

*Drinking fish, helpful horseshoe crabs
and deep-sea life*

FREE DIVING

BY VINCE RHODES

Q: My wife and I saw the movie *The Big Blue* recently. I find it hard to believe that people really free dive that deep. What is the current depth record?

A: A new world record was set on November 14, 1993 by Francisco "Pipin" Ferreras. Pipin took 2 minutes 9 seconds to free dive to a depth of 410 feet and return to the surface breaking his previous record of 361 feet set in 1991 and the previous world record of 403 feet held by Umberto Pellizzari. The dive took place off Freeport, Grand Bahamas in 2000 feet of water.

There are three free diving categories. In the Constant Weight category, the diver descends and ascends using only his flippers and without varying his weight. The diver must descend making a headfirst surface dive and may not pull himself along the guideline. The 1991 230-foot record for this type of dive is held by Pellizzari.

The second category is Variable Weight. The diver descends making use of ballast equal to one third his weight, but not exceeding a maximum of 66 pounds. The weight is normally abandoned. The diver can then pull himself up the ascent line and use his fins. This 314 foot record was set by Pipin in July 1993.

The last category is Absolute or No-Limits Diving. For this free dive, a cable with a weight attached is lowered into the water. The diver uses a sled to descend the cable to a determined depth. The sled has handles and leg rests as well as gauges, lights and a video camera. It took 1 minute 20 seconds for Pipin to reach 410 feet. His ascent was then aided by a lift bag. As he rocketed toward the surface, the lift bag exploded and Pipin was forced to swim the final four meters to the surface after being in the water for

about two minutes.

The dive, sponsored by Mares, involved a support crew of approximately 25 people including 11 Italian safety divers. In addition to their role as safety divers, the Italians documented the free dive with video and still pictures. They used both air and heliox for their breathing gases.

Jacques Mayol, subject of *The Big Blue*, was on hand to congratulate Pipin after his record-setting dive.

Q: A buddy of mine recently told me I drank like a fish. This sparked a rather heated discussion. Do fish drink?

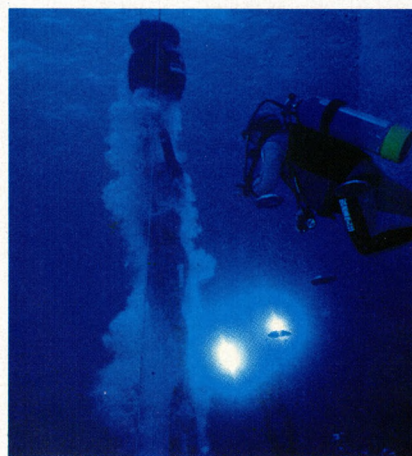
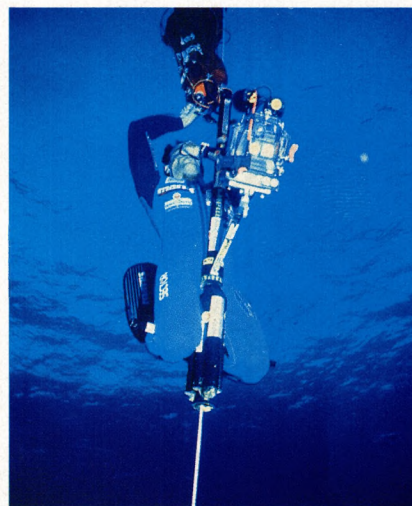
A: Some do. Fish, like all animals, have adapted to their specific conditions in order to maintain homeostasis — or a balance between their internal and external environments. Because they live in water, fish have had to change physiologically to allow their body to

maintain the proper amount of salt. The process they undergo to maintain this balance is known as osmoregulation.

Marine and freshwater environments pose different problems for fish. Marine bony fish have salt concentrations in their bodies that are roughly 1/3 that of the surrounding water. Differing salt concentrations cause water to move across membranes in an attempt to reach equilibrium. This process of osmosis causes marine fish to constantly lose water.

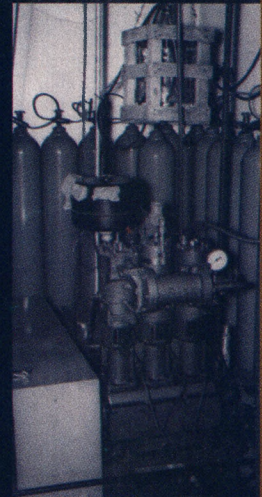
The mucous and scales which cover a fish's skin help minimize osmosis by reducing the passage of water. Unprotected areas, however, such as the gills and mouth allow unhindered osmosis. To offset this water loss, the bony fish drinks seawater. Excess salt taken in with this seawater is then excreted through the feces, urine and gills.

**PIPIN TOOK 2 MINUTES
9 SECONDS TO FREE
DIVE TO A DEPTH OF 410
FEET BREAKING THE
PREVIOUS WORLD RECORD
OF 403 FEET.**



Pipin set the world record for Absolute free diving in November.

PHOTOS COURTESY OF MARES



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Cartilaginous marine fish, such as sharks and rays osmoregulate in a different manner. These animals have high concentrations of urea, a common waste product in bony fish. Most fish excrete the urea due to its toxicity at high concentrations. Sharks and rays, on the other hand, use their urea and internal salt concentrations to match the salinity of their environment, thus preventing osmosis from occurring.

In contrast, bony freshwater fish have internal salt concentrations which are naturally higher than the surrounding water. Their problem is the opposite of the marine fish. Since osmosis causes freshwater fish to absorb water and dilute their natural salt concentration, they do not drink additional water. Instead they take in more salt and rid themselves of excess water.

Q: I've heard there are vents of extremely hot water on the ocean floor. How are they formed and can anything live near them?

A: Scientists first discovered hydrothermal vents in 1977 along volcanic ridges on the ocean floor near the high-temperature, deep-sea springs near

the Galapagos Islands. Since then, more of these vents have been found by oceanographers in the eastern Pacific.

These vents are formed when cold seawater flows down through cracks in the lava floor into the underlying crust. Heated to a very high temperature, the water returns to the surface through mineralized chimneys. These chimneys, also known as black and white smok-



A marine fish drinks water to regulate its body's salt content.

ers, can rise up to 13 meters above the sea floor.

White smoker chimneys, which are rich in zinc sulfides, issue a milky fluid under 300 degrees C. Black smokers, on the other hand, are rich in copper sulfides and issue jets of clear water which soon turn black due to precipitation of

fine-grained sulfur mineral particles. Temperatures in these jets range from 300 degrees C to over 450 degrees C.

Within a few meters of these chimneys reside a diverse population of deep-sea life including giant clams, mussels, polychaete worms that encrust the white smokers, crabs and vestimentifera worms which lack a digestive tract. Chemosynthetic bacteria which are the primary producers for this community use reduced sulfur compounds to form organic matter from carbon dioxide. The clams, mussels and worms filter bacteria from the water and graze on bacterial film on rocks. The giant clam (*Calyptogena magnifica*) and the large vestimentifera worm (*Riftia pachyptila*) contain symbiotic chemosynthetic bacteria within their tissues.

Q: We went to the beach during a recent dive trip and my daughter came across a horseshoe crab. They look rather intimidating. Can these crabs harm you?

A: Horseshoe crabs (*Limulus polyphemus*) are actually more closely related to spiders than other crabs. All three belong to the phylum Arthropoda. While crabs belong to the subphylum Crustacea, both horseshoe crabs and spiders are grouped in the subphylum Chelicerata because of their first pair of appendages.

Horseshoe crabs are often called the oldest living fossil since they have changed little since the Triassic period approximately 200 million years ago. In fact, they are the only survivors of class Merostomata. The other members of this group are all extinct.

Horseshoe crabs are often avoided because of their long pointed tail or telson. However, there is no danger of being impaled or stung by the horseshoe crab. Although often thought of as a defensive weapon, the tail actually serves as a rudder. In addition, the animal uses its telson to flip itself over if it is washed onto its back by a wave.

Far from being harmful, the horseshoe crab has many commercial uses. At one time they were gathered and crushed for fertilizer and chicken feed although the chicken eggs tasted fishy afterwards. They are still used as lobster bait. An important medical use has also been discovered for the horseshoe crab. Lysate, an extract from the animal's blue blood, is used in cancer research and as an indicator of spinal meningitis. ■

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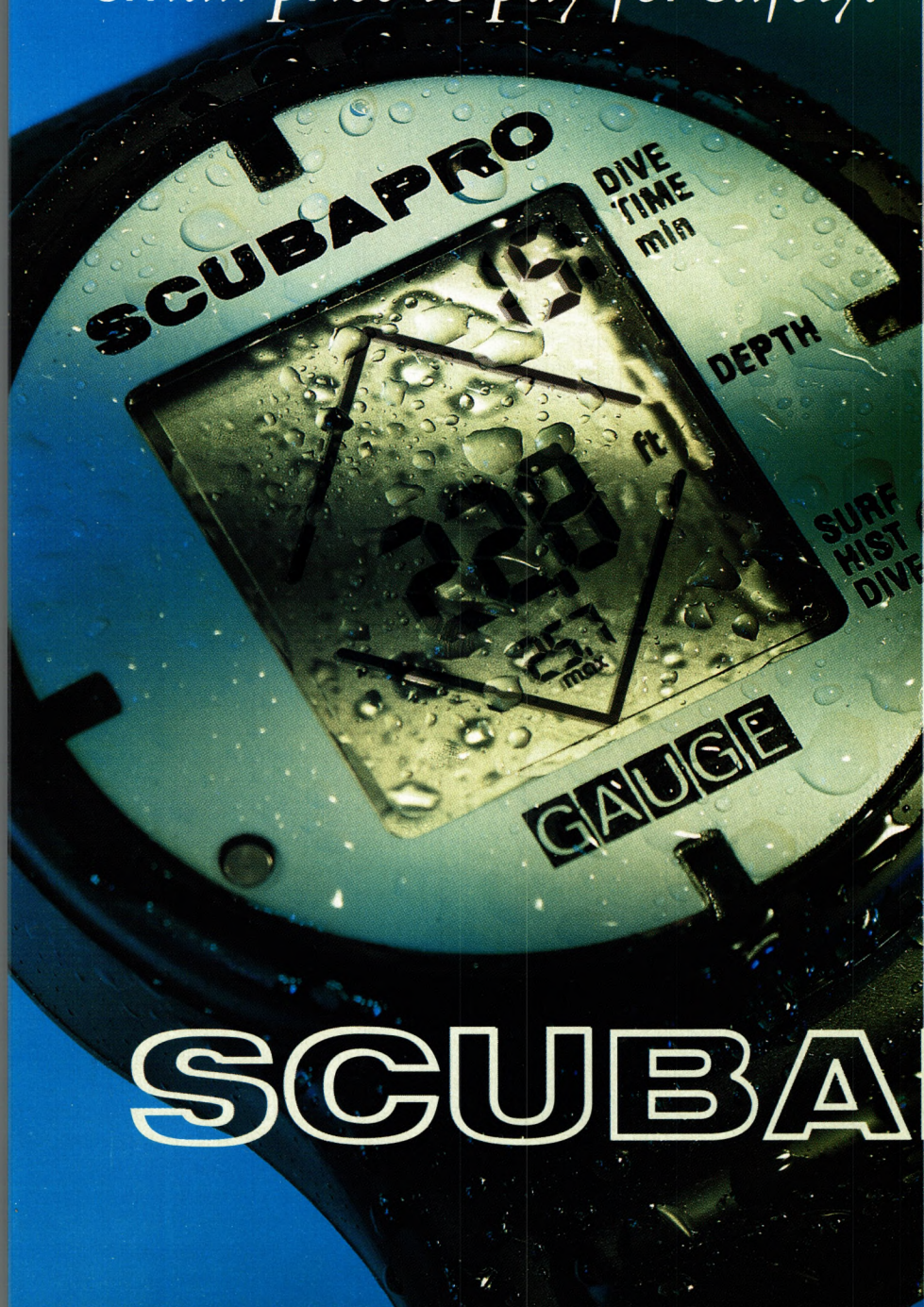
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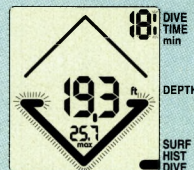
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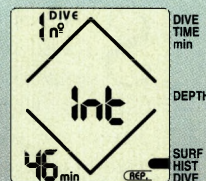
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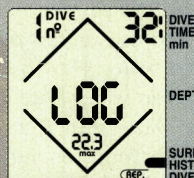
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Photo Op.

Use different films and lights to add color to your underwater photographs

GREEN WATER

BY NORBERT WU

Some of the best diving is to be found in our backyards in lakes, kelp forests, near rivers, and off beaches. Unfortunately, since these waters are so close to the mainland, water is often green. The green color arises from the presence of algae which grows in waters that are filled with nutrients — close to mainland runoff.

In underwater photography, blue water backgrounds are often preferable to green water, since most people associate ocean diving and the underwater realm with clear, blue water. Here are a few ways to make green water blue.

Tungsten Film—Use film that is balanced for use with tungsten lights rather than daylight-balanced film.

Almost all films that are used in underwater photography are called “daylight-balanced” film. This simply means that photographs taken with this film in sunlight have colors that appear natural.

Regular daylight-balanced film, such as Kodachrome 64 and Fujichrome 100 slide films, are designed to render true colors in daylight, which is blue in color.

Another type of film is called “tungsten-balanced” film. Tungsten film is designed to give natural renditions of subjects that are lit by tungsten lights. Tungsten lights are similar to ordinary lights found in household lamps, and they emit light that is orange in color.

Professional photographers rate light sources by their “color temperature” — a scale that is applied to light sources such as tungsten bulbs, strobes, and daylight. Tungsten lamps are said to have a color temperature of 3400 degrees Kelvin, which is orange in color. Day-

light and strobe lights have a color temperature of 5000 degrees Kelvin, which is bluish in color.

Underwater and land strobes give off a color of light that is close to daylight color temperatures,

and so using a strobe with daylight film gives colors that look natural. Because of the difference in color temperatures between tungsten lights and daylight, tungsten film is normally used only to photograph

subjects lit by tungsten lights, and daylight film is only used to photograph scenes lit by daylight or strobes.

Amateur photographers quite often make the mistake of using daylight-balanced film to photograph subjects inside buildings, which are lit with tungsten (household) lamps. When this happens, the lighting appears orange and the people and other subjects which are lit by tungsten illumination appear unnaturally reddish. The unnatural colors that result from using tungsten light with daylight film are usually objectionable.

On the other hand, when tungsten-balanced film is mistakenly used outdoors, or with strobe lighting, even worse coloration appears on the subjects: the people look extremely blue! And, any light source that is not tungsten, such as daylight and strobes, will also become much bluer. However, when used properly, tungsten film underwater can render green-water backgrounds into an enticing blue color.

In both of these cases, professionals who are familiar with the properties and color temperatures of their light sources and film can use this knowledge to their advantage. Many dark evening scenes which have a very deep blue cast have been taken with tungsten film at sunset, to enhance the blue color of twilight.

KNOWING THE CHARACTERISTICS OF FILMS AND YOUR EQUIPMENT WILL ALLOW YOU TO PREDICT THEIR EFFECTS IN VARIOUS SITUATIONS.



(Left) Daylight-balanced film captures the true greenish color of the water. (Right) Tungsten-balanced film can cause the same water conditions to appear more blue.

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Product Information 11



Although Ektachrome Underwater film doesn't change the blue of the water, it can cause surface light and photo subjects to appear unnaturally reddish in color.

Many professionals use daylight film at night to photograph buildings lit by tungsten lights. The resulting images capture warm, orange glows from the lights. The same knowledge of color films and their behavior under different lights can be applied for use underwater.

Motion pictures, especially underwater films, are often lit by tungsten lights simply because daylight-balanced continuous light sources have not been available. This situation is changing with the advent of HMI lights, which are expensive, bulky, and high-voltage daylight-balanced fluorescent lights.

The still photographer's strobe, which shoots off bursts of light, cannot be used in motion pictures or videos, because it does not give off light continuously. For this reason, underwater film makers (as opposed to still photographers) have long been forced to use

tungsten lights, and therefore tungsten-balanced film, for their work.

The older underwater films that you may see on television often suffer from colors and film that are not matched properly. The foreground subjects, which have been lit by underwater tungsten lights, typically look a bit reddish. The water in the background, particularly with films that have been taken in tropical waters, looks unnaturally blue.

On the other hand, underwater films which have been shot in California waters, or waters that are not as brilliantly blue as the tropics, often look more natural. The colors are truer to the mark, and the water backgrounds look nicely, subdued blue.

These two effects happen because tungsten-balanced film is being used underwater, along with tungsten lights. Remember how tungsten film makes

everything that is lit by daylight blue? It does the same thing with green water.

The foreground subjects with coral and fish will look natural, since they are being lit by tungsten lights. The water in the background, however, is being lit by sunlight. It will therefore appear much bluer on film.

If we use tungsten film in our underwater photography, then a few things will happen. Shooting green water with tungsten film will give a background of blue water. However, using standard strobes (which are bluish in color) to light underwater subjects with tungsten film will cause the subjects to look unnaturally blue.

The solution is to change the color of the light coming out of the underwater strobe. Amber- or orange-colored filters can be placed over the strobe to change the flash's color to that of the tungsten lighting.

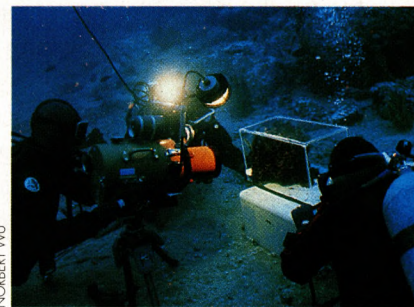
With this combination of amber-colored strobe lights along with tungsten film, the photograph will show subjects lit with natural colors, and a background of water that is bluer than it actually is.

This method of using tungsten film along with filtered strobe lights works well in green, murky water. However, using tungsten film in clear tropical waters that are already blue in color will cause unnatural-looking results.

If you are already shooting in clear blue water, then this method is not necessary. Nor is it necessary if you want to show water colors as they actually are.

Films That Tend Towards Cyan—

Use Ektachrome or Fujichrome film instead of Kodachrome. Ektachrome and Fujichrome films, like the time-honored Kodachrome film, are color slide (reversal) films that most professionals use. Both of these films have reputations for being blue, or cyan-biased film, and they will produce a more pleasing blue water background in green water than



Underwater videographers often use tungsten-balanced film and strobes.

Kodachrome.

Using Fujichrome in blue tropical waters will create a much more powerful blue-water background. Some photographers find this objectionable, while others like the intense color it creates. In some cases, it will also tend to make foreground subjects such as divers appear bluer than Kodachrome does.

In general, I use Fujichrome films only in greener waters such as might be encountered off California. In my tropical locations, I already have more blue water than I need, as sea water filters out yellows and reds quickly, within ten feet. In tropical locations, I tend to stick to Kodachrome.

In 1993, Kodak introduced Ektachrome Underwater film. Using this new film may be another answer to green water. However, in most cases it will cause green water to turn yellowish, and so I do not recommend its use in most situations.

This film is also heavily biased to reds in order to compensate for the color lost underwater. Unfortunately, in shallow water and when using a strobe (without a compensating filter), it makes everything, particularly white sand and skin tones, appear unnaturally red.

Ektachrome Underwater is best for shooting wide underwater scenics which don't include the surface of the water. At ISO 50, the film is slow, and the red bias simply makes no difference if you use it past 30 feet or so since there is no red light anyway.

In combination with this film, Tiffen Filters introduced two green colored filters to put over your strobe. These filters allow the use of strobe on subjects without making them appear unnaturally red. Using Ektachrome Underwater film without the green filters for the strobe, however, can bring back color in foreground subjects.

My feeling is that this film is a bit too specialized. I don't want to bother with putting on filters underwater, and I often include the surface of the water in my shots. If I was really concerned about bringing back red colors in my shallow underwater shots, I would probably just bring down a red filter to put over my camera lens.

Many photographs taken in lakes and greener waters will have value by simply showing life as it is, and that includes greener water. If, however, you'd like to make your lake dive seem nicer and more enticing than it actually might have been, using the first method

might be worth a try.

The best way to get a blue water background, of course, is to travel beyond the green water of the continents, out to the deep blue of the oceanic islands.

Keep in mind that all photographs attempt to represent reality, but the characteristics of each film, the lighting, and even the color balance of the camera lenses that you use all have an effect on altering the reality that your eye sees.

Knowing the characteristics of films and your equipment will allow you to predict their effects in various situations. It is only through constant experimentation that photographers develop a sense of what to use in different situations, and for me, this is what makes underwater photography challenging. 

Underwater naturalist and photo journalist Norbert Wu's work has appeared in a variety of print media.

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Skills Review

*Precise buoyancy control is an acquired skill
that continues to improve with experience*

IN CONTROL

BY PIERCE HOOVER



MARTY SNYDERMAN

Proper buoyancy puts you in control of your dive, enhancing both safety and enjoyment.

Every basic scuba course includes a lecture on buoyancy control, followed by pool practice on “fin pivots” and such. But the learning doesn’t end with the classroom sessions. Precise control of body position, movements and depth is a skill that divers continue to perfect throughout their careers, and some have even elevated it to an art form.

On a typical dive, you may see novices working to stay off the bottom under the watchful eye of a divemaster who seems to hover effortlessly in place, scarcely moving a muscle while gliding along the reef. Most of us fall between these two extremes, but while we may feel comfortable with our current control skills, there is always room for

improvement.

At the most basic level, buoyancy control is a safety issue. The diver who is unable to perform a slow, controlled ascent, and to hold a constant depth for a safety stop, increases the chances of decompression illness and possible air embolism.

An equally important benefit of proper buoyancy control that has been given much publicity in recent years is the protection of the marine environment. Most divers now understand the importance of staying off a fragile reef, and many are beginning to realize that even seemingly lifeless areas of

sand or mud bottom are actually home to a myriad of sea life.

A third and less obvious benefit of precise buoyancy control is the personal comfort and satisfaction a diver gains when they are in total control of their body position, and look and feel as comfortable in the water as the fish around them.

Factors Affecting Buoyancy—Most items a diver wears or carries are either positively or negatively buoyant, and it is the diver’s job to balance these items and arrive at near neutral buoyancy. The buoyancy compensator can then be used to fine tune buoyancy rather than for correcting gross misweighting.

Divers may either float or sink depending on their body composition and what type of dive gear they are wearing. A thin, muscular diver in a skin suit may not need any additional weight to sink, especially if that diver is using a steel tank. A heavier person diving in cold water, on the other hand, may need to add significant amounts of weight to overcome the buoyancy of body fat and a thick wetsuit.

Neutral buoyancy is not a static matter however. There are several physical laws at work on the diver that will cause changes in buoyancy based on depth and dive time.

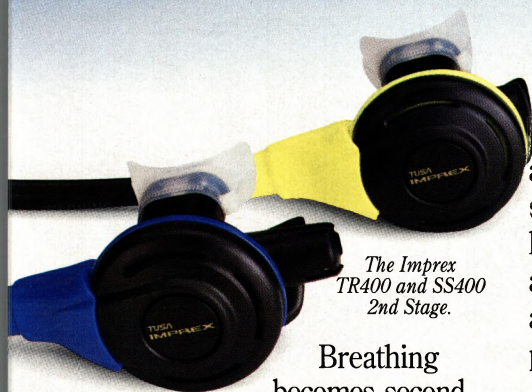
Wetsuit compression is a fairly obvious change that takes place as the diver goes deeper. As water pressure acts on the trapped nitrogen bubbles within the suit, they are compressed and the suit loses a portion of its positive buoyancy.

As a result, divers wearing wetsuits must add air to their BCs as they descend. The thicker the suit and the greater the depth of the dive, the more air must be added. That’s why BCs

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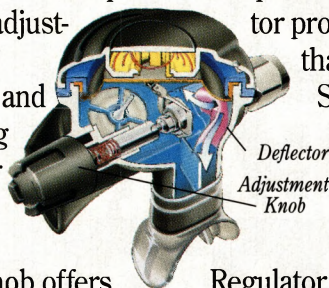


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used for cold water typically have greater lift capacities than "tropical" BCs do.

But even with minimal or no wet-suit compression, divers may notice a more subtle but very real buoyancy change as they move deeper. The air captured in a BC will compress as the diver moves deeper, resulting in a net loss of buoyancy.

Most divers are quite familiar with the correlational effect that occurs as they ascend. Expanding air in the BC must be vented upon ascent to prevent an escalating increase in positive buoyancy; hence the hand-on-hose ascent position taught by many instructors.

The secret to adding air to or venting a BC is to make subtle changes. New divers often overcompensate, realizing too late that their accelerating descent will end in a collision with the bottom, they then "slam on the brakes" by adding too much air to the BC. Upon ascent, they may wait until they are rising too fast to vent air, rather than practicing a slow, controlled ascent with small but continuous ventings.

One additional factor that will cause buoyancy shifts during a dive is the loss of air from the scuba tank. We some-



PAT CANOVA

Maintaining neutral buoyancy protects the reef from damage due to accidental contact.

times describe things as being "light as air," but air does have some weight, just over an ounce per cubic foot at sea level. That means that a regular 80 cubic foot tank will weigh six pounds more when filled than empty.

Divers must take this into consideration when weighting themselves for a dive. Rather than trying for neutral buoyancy with BC deflated at the beginning of the dive, the diver should figure in the buoyancy shift the tank will cause. This will allow him to remain in control at the

end of the dive, rather than fighting to slow or halt an ascent caused by the increased positive buoyancy of the tank.

Improving Buoyancy—The first step towards improving your buoyancy is being aware of it. New divers sometimes suffer from "tunnel vision," and may become so caught up with the act of breathing underwater or clearing their mask that they don't notice that they are kicking or hand sculling to hold their position in the water column.

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But it isn't just novices who should focus on buoyancy control. Advancing divers can concentrate on the effects small shifts in depth or breathing can have on buoyancy. Often, a tense diver will breath heavier and retain more air in the lungs, causing an increase in positive buoyancy. As the breathing rate drops and less air remains in the lungs, the diver will lose buoyancy.

Skilled divers have learned to fine tune their buoyancy to the point where breath control is all that is needed to make small adjustments in depth. For example, an extra deep exhalation will cause a slow sink, which is then stopped by a full inhalation.

Trim and Weighting—There are no exact weighting formulas that will work for all divers in all conditions. In general, you will want to add weight as needed to remain neutral or slightly negatively buoyant throughout the dive, but you will also want to avoid excess weight that will force you to add extra air to the BC and increase water drag.

Perfect weighting won't happen on the first dive. To make sure you don't repeat the same mistakes from one dive trip to the next, keep a written record of

your weight and equipment from each dive. This will allow you to add or subtract weight on subsequent dives until you arrive at the correct weighting.

Keep in mind that changes in wet-suits or the gear you carry will play a role in your weighting. Cameras, lights, or other negatively buoyant gear carried throughout the dive might allow you to take a pound or two off the weight belt. On the other hand, a switch from a summer shortie to a winter suit will necessitate a few extra pounds of lead.

Another area closely related to buoyancy is trim. A diver might be perfectly neutral, but have the weight belt and BC pulling against each other uncomfortably, or be fighting to keep from rolling over or being pulled into a vertical position.

One simple way to prevent the "topheavy" feeling some tanks create is by moving weights to the front of the weight belt. This will concentrate the weight on the underside of the diver, while the majority of buoyancy remains above in the BC.

The diver can also shift the weight belt up or down on the torso to shift the center of gravity. For example, moving

the weight belt up from the hips to the upper belly will promote a horizontal position.

One other way to change horizontal trim is by shifting the tank up or down in the backpack. If the diver wants to assume a more "heads up" position, the tank can be moved lower in the backpack, while raising it will result in a more "heads down" horizontal swimming position.

If the weight belt contains significant quantities of lead, some portion of that weight can be redistributed to the tank, backpack, or vest to influence body position and trim. If this is done, remember to leave enough weight on the belt to create positive buoyancy for an emergency weight belt removal and swimming ascent.

Keep Diving—The reason veteran divers often have better buoyancy control than do novices is because they have spent more time underwater.

And that, in the end, is really the only way to acquire and perfect your body position and trim while diving. The more you dive, the more comfortable you will become with the underwater environment. 



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*The right equipment and technique
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ANCHORING

BY CAPTAIN RICK GAFFNEY

If you own a dive boat, you should own at least one anchor. However, no single anchor is appropriate for all the bottom conditions you will encounter as a diver.

Before we begin our discussion of anchoring, let us consider the damage anchors can do to a fragile marine ecosystem. Wherever you drop an anchor, it is likely that some marine critter may be impacted. For that reason, an increasing number of popular dive sites are equipped with permanent mooring buoys.

If there are permanent moorings available, don't use an anchor. Moorings are installed for good reason — to protect the environment — and anchoring in an area that provides mooring buoys is probably illegal anyway.

Coral reefs very quickly suffer from the ravages of anchoring. The fragile calcium carbonate condominiums built by the tiny coral polyps are no match for steel or aluminum anchors or for anchor chain.

Even eel grass beds, mud bottoms and sand are home to marine animals, invertebrates and algae, and a dragging anchor can plow disruptively through these habitats.

Marine wrecks also suffer the ravages of poor anchoring. Slow destruction of fragile structures lessens the attractiveness of a wreck for both divers and various marine organisms.

The environmentally sensitive diver will seek to minimize these impacts while safely anchoring their dive boat. Divers do have one unique opportunity that is unavailable to most boaters, and that is the ability to carefully reset an anchor once they get to the bottom.

This should be a practice, not an option, for it assures not only the security of your vessel while you are gone, but also minimizes the damage your anchor may cause while it is on the bot-

tom. Any anchor which is secured on descent can easily be freed before ascent at the end of the dive.

Anchor Types—Modern anchors use a combination of weight and design to provide holding power. Some rely more on their weight, others primarily on design.

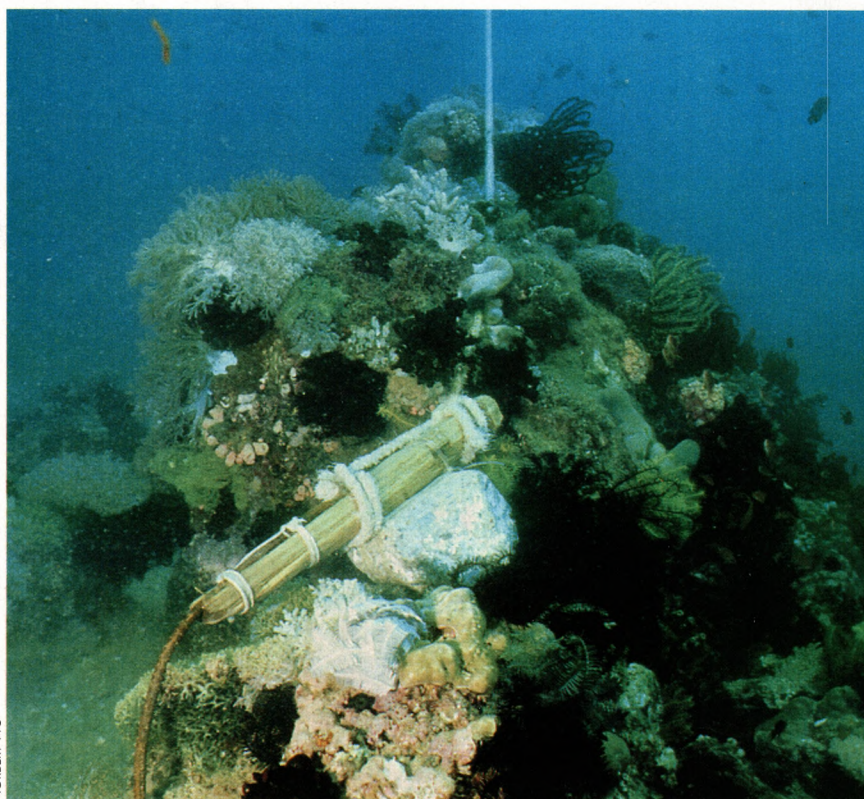
The old kedge or yachtsman-type anchors which you see most commonly today outside dive shops, seafood restaurants and maritime museums are actually quite effective, holding well on all types of bottoms. They are just too unwieldy for reg-

ular use on small boats, and are therefore rarely found on dive boats.

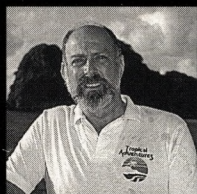
The slightly more modern navy or stockless-type, seen on most large, ocean-going ships housed in a hawse pipe ready to drop, is also unsuited for most pleasure and dive boats. A navy-type anchor light enough for easy handling would be less effective than any of a number of other anchors available today.

The need for a lightweight, folding anchor that was easy to stow and deploy from navy seaplanes led to the development of the Northill anchor, which is

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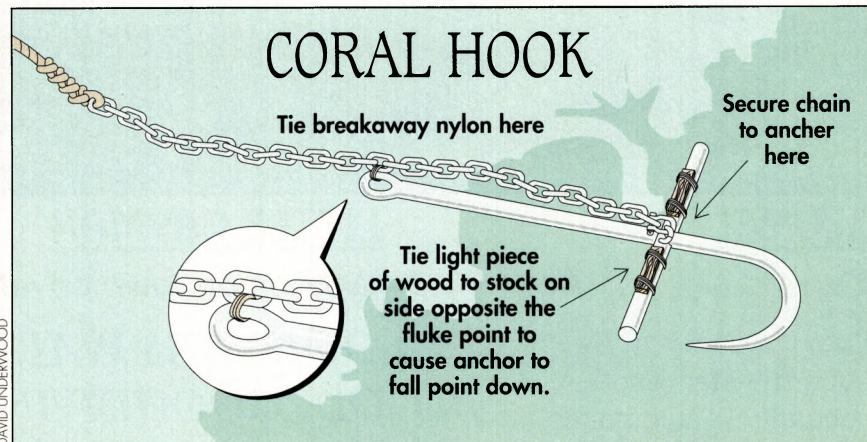
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Product Information 53

CORAL HOOK



DAVID UNDERWOOD

quite effective for anchoring small boats in many types of bottom conditions. The ability to fold the stock up against the anchor's shank makes these anchors easy to stow and carry in virtually any boat. Northill-type anchors are a lot less commonly used on dive boats than they probably should be.

Another lightweight workhorse for small and medium-sized boats, and perhaps the most common anchor in use today, is the Danforth-type. Hinged flukes respond to any pull on the shank by digging down into the bottom and taking a firmer bite — provided the bottom is reasonably soft. Danforth anchors are not an appropriate choice on hard bottoms, but are great in sand.

The middleweight plow anchor looks much like its namesake from back on the farm. Most commonly seen on cruising boats and larger powerboats, these anchors promise a secure hold in the sand, soft mud, weeds, kelp, and even shell beds, but they are also a poor choice on hard bottoms, and their weight and unwieldiness make them a less popular choice on many dive boats.

The folding-type anchor stows in the smallest amount of space, and is therefore often the first choice of inflatable boat owners. The four folding flukes pull away from the shank when in use, and offer an effective toe-hold in rocks, making these anchors a reasonable choice in many dive boat anchoring situations.

The grapnel anchor features a number of tines radiating out from the shank in an umbrella-like array, promising a quick hold in rock or other hard substrate. Grapnels with tines that can be bent when put under pressure allow for easy retrieval when lodged in a rocky bottom. These anchors are also commonly used by wreck divers for snagging a wreck — an effective but poten-

tially damaging practice.

One additional anchor type which is a lot less common than perhaps it should be, particularly on dive boats, is the Japan-type which is sometimes called a coral hook. The single fluke, relatively long shank and unique retrievability makes this anchor a good choice for many dive boats in tropical and subtropical waters. Fabrication is easy and most welding shops can whip one up and have it hot-dip galvanized. (See diagram for rigging tips.)

Chain and Line—Most anchors are rigged with a length of chain (the rule of thumb dictates one foot of chain for every foot of boat length) to prevent chafing of the anchor line on rough bottoms and to add weight (and catenary) to the anchor shank and line, forcing the anchor to work more effectively.

Temporary anchoring for a dive can be accomplished with little or no chain if you always hand-set your anchor when you first descend. Limiting the amount of chain will often lessen anchor damage, particularly as your boat rotates around its tether in wind, current and tidal changes.

The preferred anchor line is nylon for both its ease of handling and stress-reducing stretch. Polypropylene appears attractive to many because of its price, floatability, and bright color, but it is awful to handle, difficult to stow, less secure to splice and weaker in comparative diameter than nylon. Accept no substitutes for nylon when it comes to anchor line.

The length of anchor required on any dive boat depends on the maximum depth of water you will anchor in. Safety dictates a minimum scope of five-to-one in any anchoring situation. That means if the water is 70 feet deep, you'll need 350 feet of anchor line to assure

that your anchor will work correctly. If your dive boat came with anchor line, chances are it is far less than you need for anything more than shallow water tethering on a "lunch hook".

If you leave your dive boat with no one on board while you search the water beneath it, it is nice to know that it will probably be where you left it when you return. If surface conditions may put more stress on your boat while you are gone, add more scope before you leave.

Dropping Anchor—Proper anchoring includes the placement of the right anchor in the appropriate bottom, for both environmental and safety reasons. If you carry more than one type of anchor you can make that choice as you arrive at the dive site.

With most modern depth finders it is relatively easy to determine bottom type, and if the visibility is good, a glance over the side will help you determine the prime place to drop your hook. If conditions allow, a dive buddy can don a mask and snorkel and guide you to an optimum bottom area.

Once over the bottom you want to set a hook in, the person handling the anchor should lower it into place, then instruct the boat operator to back down slowly as the anchor contacts the bottom. This will lay out any chain and set the fluke(s). Dump the anchor along with a big wad of chain and line, and you are more than likely to foul your hook.

Once on the bottom before you begin your dive, set your anchor well in the soft bottom you have picked out to minimize damage. On hard or rocky bottoms, you may want to lodge the anchor in a nook or cranny or wrap your anchor chain around a boulder. If you are on a wreck, you might want to shackle your anchor line to a solid spot on structure to assure you that the line will not walk away (and take your boat with it) in your absence.

Anchoring is an art, especially when environmental considerations come into play. Spend some time considering the optimum anchor types for your boat and regular diving conditions, rig one or more anchors for the depth of the water you generally encounter. Wherever you dive, remember to think twice before dropping your hook. The marine environment will thank you for it. ■

Prior to launching his career as a world-traveling photojournalist, Kona-based Captain Rick Gaffney was a dive boat operator for a number of years.

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Safety Through Education

*Advanced diving requires
advanced training*

GETTING TECHNICAL

BY TOM MOUNT

The leading edge column is *Sport Diver's* forum for advanced and technical diving issues. In the months to come, we will discuss many of the techniques and technologies specific to that area of the sport. But before we can discuss advanced diving, we need to define the term and provide a brief overview of what it involves.

We're not talking about advanced open water or advanced diver certifications here, but of true advanced diving practices. In other words, dives that involve training and/or practices outside of the spectrum most certification agencies offer. These include decompression-stop diving, dives deeper than 130 feet, wreck penetration, cave exploration and dives using mixed gas.

Recent surveys show that such practices are not as rare as some might claim. In fact, the numbers indicate that a significant portion of the diving public fall into the above categories, most often in the categories of decompression stops and dives deeper than 130 feet.

It is sad that with the growing popularity of advanced, or "technical diving," there is resistance to recognize or offer training and education to meet the needs of divers involved in the above activities.

The History Of Technical—The recently expanding group of advanced or tech divers has existed since the inception of scuba.

Jacques Cousteau, the man who did the most to popularize the sport, was in fact the first technical diver.

In 1962, when I was first discharged from the Navy, I met dozens of Florida cave divers, New England wreck divers, and Caribbean dive masters who were routinely plunging to depths of 200 feet and



Cave diving enjoys a good overall safety record, thanks to training and safety standards.

deeper.

The *Andrea Doria* had been dived in 1958 on an expedition lead by Peter Gimbal. Several caves in Florida had already been explored to depths in excess of 200 feet by a number of cave divers, including Dr. Lee Somers and Wally Jenkins.

Then, as now, much effort was spent attempting to deny that these practices actually took place. Much of the opposition to technical diving

has historically come from our West Coast. By contrast, on the Eastern Seaboard and in the Great Lakes, deep, cave, wreck and technical diving have always been an accepted subset of the diving population.

Yes, it is true some of the early technical diving pioneers were west coast divers. However, these folks were forced so far underground that many publicly

denied such diving practices in order to avoid local censorship.

The Need For Training—There are increased risks involved in deep diving and especially deep air diving beyond 130- to 180-foot depths. The very real and potentially lethal limits of oxygen toxicity await the diver descending below 220 feet on air. Proper training and correct gas mixtures can reduce but not remove these risks.

But, while critics might seek to discourage such advanced practices, they should instead focus on educating divers to recognize risks and make informed personal choices to either avoid or minimize those risks.

Cave diving, probably the most demanding form of technical diving, has grown into a popular sport. Through the efforts of the NACD, the NSS/CDS and more recently IANTD, this hazardous and highly technical form of diving boasts a high overall safety record. Why?

RECENT SURVEYS SHOW
THAT ADVANCED
AND TECHNICAL DIVING
PRACTICES ARE NOT
AS RARE AS SOME
MIGHT CLAIM.

Because the agencies involved are instrumental in providing the specialized training required and educating the diving public on the need for specialized qualifications.

Today we are on the threshold of a diving revolution. Enriched Air Nitrox, trimix, deep air, wreck penetration diving, and cave diving are all becoming more popular. These are sophisticated and potentially hazardous forms of diving, and divers must be made to understand that specialized training must be sought out before they engage in such activities.

Enriched Air Nitrox (EANx), the ideal recreational diving gas, was first met with resistance and originally viewed as a form of technical diving. Today it is well represented by two agencies, both with excellent standards: the American Association of Nitrox Divers (ANDI) and the International Association of Nitrox and Technical Divers (IANTD). NAUI, YMCA, SSI, and NASDS recognize EANx training through the above two agencies and provide specialty ratings in conjunction with these programs. IANTD, NAUI, SSI, YMCA, and NASDS also provide insurance coverage for EANx diver training.

Advanced Training Sources—There are a number of agencies now addressing the information, training and certification requirements of the advanced and technical diving public. Each offers various certifications ranging from enriched air nitrox use through advanced forms of technical diving.

IANTD—The first program to make training available in all areas of technical diving, was founded in 1985. The standard programs include: Introductory Nitrox (EANx) diver, EANx diver, Advanced EANx diver, Deep Air, Overhead Environment diver (cavern and limited wreck penetration) and Introductory Cave diver. Technical diver programs include: Advanced Deep Air, Technical Deep Air, Technical Nitrox, Trimix, EANx Gas Blender, Trimix Gas Blender, Cave diver, Wreck Penetration diver, Advanced (specialty) Cave diver, Rebreather diver, plus Dive Supervisor ratings in each of the preceding, Instructor ratings at all levels and Instructor Trainer qualifications. IANTD also publishes a quarterly journal on all activities and advances in diving technology.

NACD—First formed in 1969, its programs include cavern diving, single tank cave diving, cave diving, cave diving specialties, single tank wreck penetration diving, double tank wreck pene-

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tration diving, and Instructor levels for all categories. NACD produces a quarterly newsletter on cave diving and advances in cave diving.

NSS/CDS—Became a chapter of NSS in 1971 whose programs include cavern diving, introduction to cave, apprentice cave, cave diving and cave diving specialty courses. Instructor certification is available at all levels. NSS/CDS provides a quarterly journal on activities related to cave diving.

PSA—The oldest deep air certification program with a perfect safety record

for the nearly 30 years it has been offering training dives, PSA's programs include multiple levels of deep air diving to depths in excess of 200 FSW and Instructor qualifications in each level.

ANDI—The newest addition to EANx and technical diver training was founded in 1989. ANDI has recently added several technical programs. Certification is offered in limited EANx user, complete EANx user, a planned technical nitrox certification, gas blending, service technician, dive master, an extended range diver program and trimix. Future

plans including a rebreather course.

Training Philosophies—Divers seeking technical training need to know not only where to go, but also what to expect. Be certain the instructor is qualified to teach whatever specialty you are seeking.

In the areas of EANx, trimix, cave and wreck diving, there are qualified certification programs listed above. If an instructor is certified through one of these agencies they are competent to teach the program you are seeking.

In highly specialized areas, avoid the self-proclaimed expert. Check references and find out the background of a technical instructor.

A good course should be balanced to provide both the theory and practical knowledge needed for technical dives. Any course of this nature should employ lectures on the psychological aspects of diving as well as in-depth presentations on diving physiology. Stress management exercises, equipment familiarization drills and simulated emergency situations will also be incorporated with either pool or open water drills in a reputable program.

In general, advanced/technical dive courses must:

- Develop stress control
- Develop a realistic psychological understanding, control and outlook towards technical diving
- Develop self reliance
- Develop equipment awareness
- Develop outstanding technique
- Develop recognition of personal limits
- Develop procedures for expanding personal limits and comfort zone
- Practice equipment redundancy.

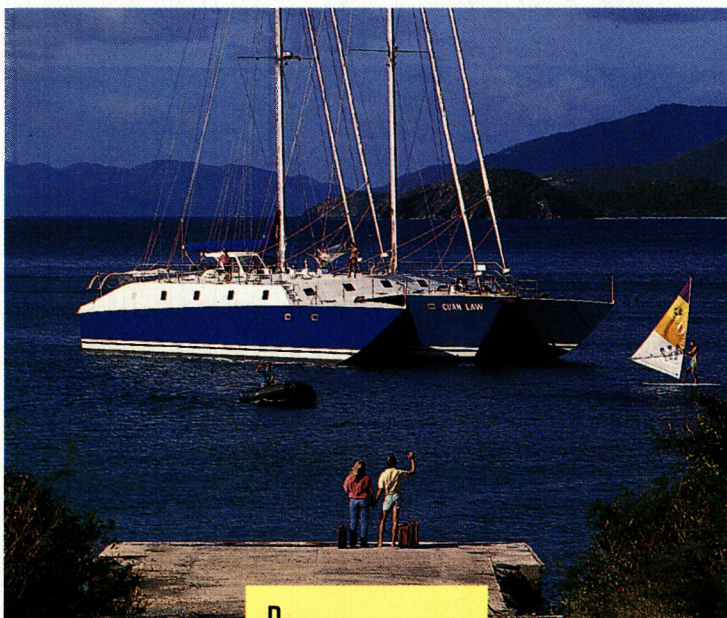
Such courses should not:

- Encourage one to exceed their personal comfort zone
- Encourage or allow ego to push limits
- Allow dependency or "trust me" diving
- Push equipment or gas limits
- Allow an Advanced/Technical dive until the student is able to prove stress management abilities in a protected training environment.

Education and skills development are the keys to any safe dive, and the editors and staff of *Sport Diver* encourage the dive community to recognize the roles continuing education and the establishment of personal limits and responsibility play in safe diving. ▀

Tom Mount was a founding member of the NACD and is currently president of IANTD.

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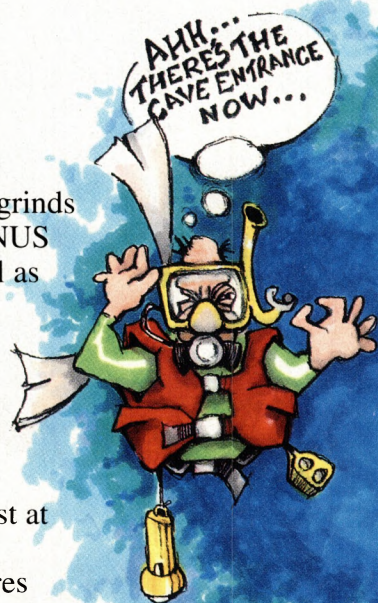
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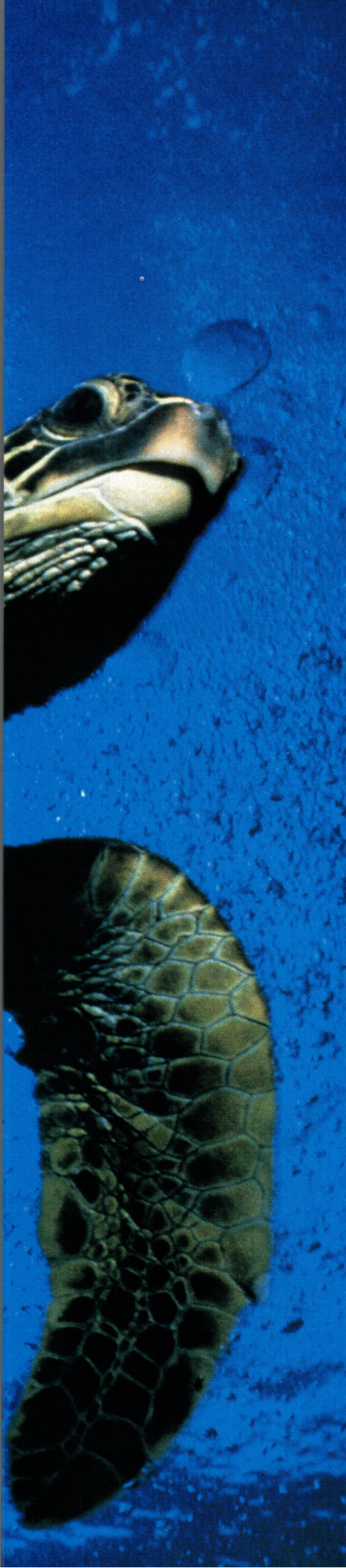
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Forget the Sharks, Watch out for the Turtles

When people find out that I am a professional diver and underwater photographer, the first question they usually ask is "Have you ever been bitten by a shark?"

Well, the answer is yes! But, in over twenty years of frequent immersion in tropical oceans, I have also been menaced by a dolphin, punctured by urchins, shoved around by a whale, bloodied by a triggerfish, charged by a sailfish, pinned down by an octopus, sexually harassed by a dolphin and attacked by turtles — not once, but four times.

by Doug
Perrine

I accept the blame for provoking most of these incidents. Anybody who comes into contact with wild animals has to recognize that most animals — not just the ones that Hollywood has taught us to fear — have defensive and offensive weapons

A fearsome denizen of the deep? Only if you look like a free lunch!

DOUG PERRINE



A loggerhead attempts to feed on a queen conch but is foiled by the creature's armor-like shell.

that can be a problem if they are made to feel threatened, or if they associate humans with food.

Sea turtles are widely recognized as inoffensive creatures, and it is true that they are naturally shy, and do not normally feed on humans. They can show curiosity and even affection if approached in the right way. However, it should not be forgotten that their brains are about the size of a pea.

I first learned to fear sea turtles before I even learned to dive. One fine sunny morning I was sitting on a surfboard in Hawaii, with my legs dangling in the water, waiting for the next set of waves. Happening to glance down at my bare toes, I saw a turtle about to clamp its mouth down onto them.

Startled, I jerked my feet back, spooking the turtle. But a moment

later it was back again, still attempting to graze on my wiggling digits. I pulled my feet up onto the board, feeling the first pangs of gnawing paranoia.

The fact that sharks had been reported at this spot recently wasn't making me any more comfortable about the dark shape I could still see circling around under the board. Abruptly, the water a few feet to my left seemed to explode as another dark form came hurtling out of the depths and into the air. Dolphins may be a symbol of good luck, but I'd had enough — I paddled ashore.

About ten years later I managed to talk my way into a private cove in Cozumel where a restaurant owner was holding a collection of fish

and turtles. He was reluctant to let me in because the animals, including a large barracuda, were not accustomed to having people in the water, and he was afraid they might be territorial.

I promised him I would get out if threatened by the barracuda,



Photographers Bob Cranston and Howard Hall at work with a more cooperative subject.



DOUG PERRINE

I was told that all I had to do was go down on the right reef with some squid in my pocket and she would find me. Sure enough, about two-thirds of the way into the dive she came rocketing out of nowhere straight toward our group. As soon as I showed some squid, she was right in my face.

In underwater photography, close is good, but bumping against the camera is a little too close. So I tried tossing a piece of squid one way and swimming the other, then waiting to get a shot as "MP" approached again.

The problem was that she approached at warp speed, and was in my face again before I could get a shot off. Pretty soon she got the idea that I didn't want to give her all the squid and started to become more aggressive. About that time I ran out of squid.

Now I had a spoiled, hungry, juvenile turtle with no fear of man pecking at me frantically, trying to get at the food that I didn't have. Bits of neoprene began to float through the water as she shredded the neck of my wetsuit. Realizing that my jugular would be soon be exposed to the attentions of this mad reptile I fell back on my tried-and-true strategy for dealing with ninja turtles, and beat a hasty retreat to the boat.

When Howard Hall approached me last year to work as the science consultant on his new film (to be broadcast April 13, 1994 on TBS), based loosely on the trials and triumphs of a sea turtle in the Caribbean, he didn't know that I had a pretty bad track record with turtles. And of course, I didn't volunteer the information.

He wanted to get footage of natural behaviors, including feeding. I suggested a wreck site on the Little Bahama Bank where several loggerhead turtles show up to sleep most nights, and sometimes hang out during the day.

Many people don't realize that

the feeding ecologies of the three types of sea turtles commonly found in the western Atlantic area are completely different, and change as the animal develops. As adults, green turtles are primarily herbivorous, grazing on sea grasses, while hawksbills specialize in sponges and jellyfish, and loggerheads prefer shellfish.

"Bits of neoprene began to float through the water as she shredded the neck of my wetsuit."

The massive head of the adult loggerhead has clearly evolved for the purpose of crushing the crabs, lobster, and sea shells upon which it feeds. It is one of only two animals in the ocean reputed to be capable of breaking the thick shell of the adult queen conch (the eagle ray is the other).

A ranger at Cape Florida State Park must have had that in mind a few years ago when he warned off an overly emotional reporter who was using her hanky to dab away the salt gland secretions from the eyes of a loggerhead turtle which had come ashore to lay its eggs. Tiring of trying to explain that the turtle was not really crying, he finally informed her that the turtle could take off her arm if it wanted to, and that she should keep a respectful distance.

The next day he was called into his supervisor's office and asked to explain a story in the local paper about the threat from "man-eating" turtles.

I suspected that the loggerheads that used this particular wreck would be suitable for our purpose because the wreck also frequently attracted the nocturnal

and kept one eye trained on it as I attempted to get some close-ups of a green turtle. I paid no heed to the 400-pound loggerhead turtle which lay by my feet like a huge rock until I felt a nudge on my foot and looked around to see its massive beak closing onto my foot.

I was just able to yank it out of the way in time to avoid losing the foot. The turtle had come to accept anything that was thrown into the pond as food, so when I moved over to the other side of the cove, it came right after me, determined to eat me before the barracuda did. There was nothing to do but get out.

A few years after that I had a better plan for getting a picture of a green turtle. Divers on the Kona coast of Hawaii had trained a young green to accept squid from their hands. Her voracious appetite had earned her the moniker "Miss Piggy."

variety of *Homo sportdiveri*. In the summertime, hardly a night went by that the lumbering giants weren't roused from their sleep by a gang of bubble-blowers that wanted to take them for a ride.

The big turtles seemed to regard divers as nothing more than a minor nuisance, so I hoped that they would not be perturbed by our attempts to film them. This was also a perfect location to test their ability to crack conch, as the wreck is surrounded by flat limestone

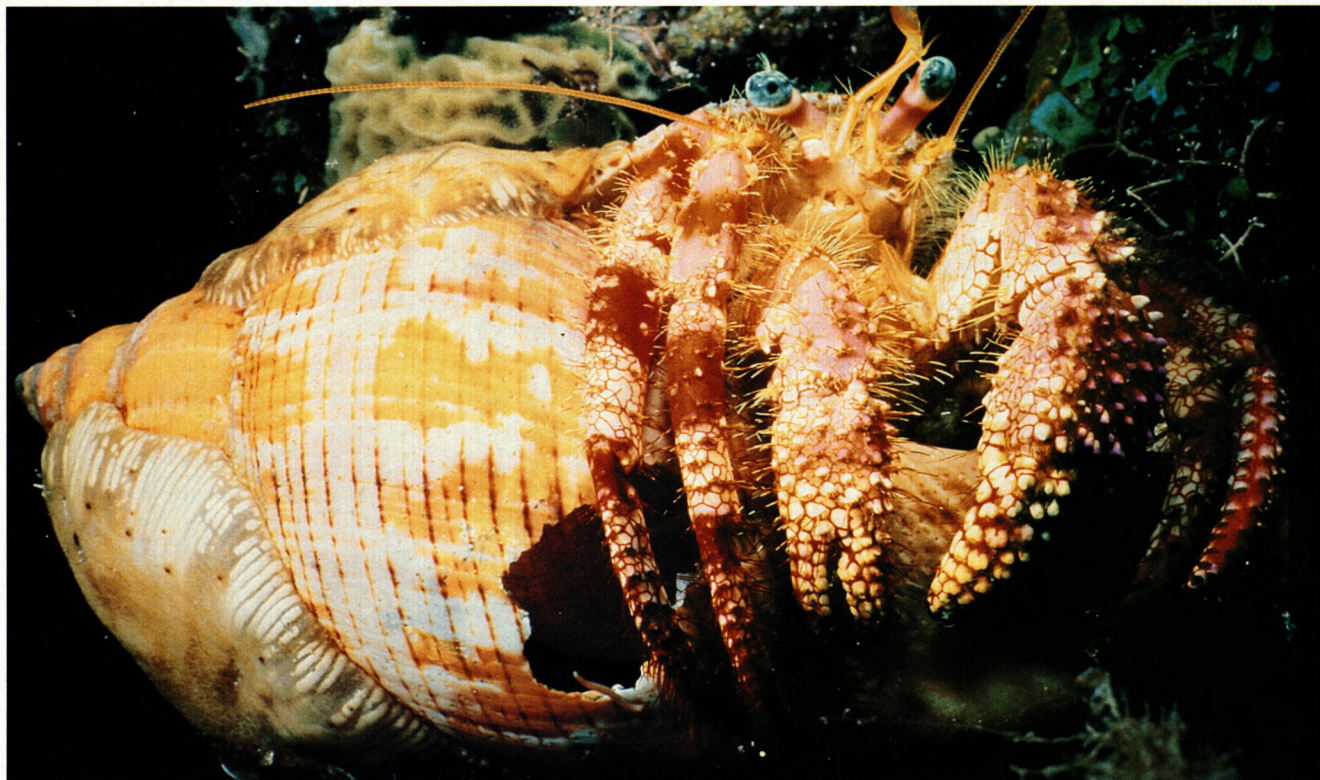
outside its den, and held it between its flippers while it tried to bite through the shell, but to no avail.

When I tried tossing some less formidable shells in its path, though, it was a different story. Tulip shells and chank shells disintegrated in the vise-like grip of the powerful jaws.

In spite of my attempts to be inconspicuous, it didn't take the turtle too long before it began to identify me as the source of the free meals. That's when my

see if Howard was capturing the turtle's feeding behavior on film I'd see that it had passed right over its intended meal and had visually "locked-on" to my red fins. I'd seen what those prodigious jaws could do, and it wasn't at all comforting to see them open wide as the turtle approached.

In my faded red diveskin, I was probably about the color of a giant pink conch. There was no way I could outswim the turtle in a straight line, so I had to try



DOUG FERRINE

This stareye hermit crab (*Dardanus venosus*) with an anemone on its shell demonstrated amazing navigational abilities.

bottom with queen conch grazing across it by the hundreds.

However, it turned out that this item did not seem to be on the diet of these particular turtles. Perhaps a really, really huge loggerhead would have a jaw capable of defeating the fortress-like shells. The turtles that we found on the wreck by day were big ones, weighing several hundred pounds, but not the largest I've seen.

When I showed one the pink underside of a conch shell, it would definitely get interested and come over to check it out. Once one even picked up a conch that we'd left

problems began.

I'd drop a shell in the turtle's path, and swim out of the way as quickly as I could. Looking back to

“It passed
right over its
intended meal
and visually
locked-on
to my red fins”

maneuvering. I began to make tight circles around the camera, hoping Howard would at least get some close-up swimming footage of the turtle.

As the circles became tighter the turtle had more chances to take a snap at an elbow, a knee, then after the fins again. Rolling any film was hopeless, not only because the turtle was too close on my heels to get a clean shot, but also because Howard was doubled over laughing too hard to hold the camera steady if he tried.

I was on the verge of passing out from overbreathing my

regulator — not so much due to fear of actual injury as from mortification at the thought of the embarrassment of becoming hors d'oeuvres for a pea-brained reptile — when I finally escaped.

One day when the turtle left the wreck, we swam out across the “hardpan” hoping to see what the turtle did when it was away from home. This expanse of almost featureless flat bottom stretched for

thumb. He swam over to investigate and spotted some squid eggs underneath.

When I lifted the rock to have a look at them, I also found a hermit crab underneath, a large star-eyed hermit (*Dardanus venosus*) with a collection of symbiotic anemones on its shell. There was a hole in the shell through which one eyestalk would poke out like a periscope when it withdrew into the shell.

I figured the crab-anemone

hiding places there than under the lonely rock out on the hardpan.

The next morning, Howard went back to his rock to check on the squid eggs. When he got back to the boat he told me that there was another hermit crab with anemones under the rock. “It’s really cute,” he said. “It has a little hole in its shell, and one eyestalk pokes out so that it can look at you when it’s pulled back inside.”

I wasn’t really looking forward to another mile-long swim out to the squid rock in heavy current, but I had to check it out. I pulled my fins onto my blistered feet and swam on out there.

Sure enough, there was my buddy, sitting right under the same rock I’d pulled him from the day before. The pattern of anemones on the shell and the unique hole left absolutely no doubt: it was the same crab.

After being carried around in a dark BC pocket for half an hour, then stuck in a tank on a swinging boat for eight hours, dropped off in a strange place and blinded with a strobe flash, it had crossed a mile of unprotected open seabottom during the night to find a rock about two feet in diameter. Somewhere in that crab’s four-inch body was a tiny navigational computer that could outperform the most sophisticated satellite navigation system on the market!

Author’s Note: Relocating animals can be harmful or fatal to them. Feeding wild animals can be dangerous to the animal, to the person, and to other persons who may encounter the animal at a later time, as well as being an inconvenience to the item used as food. Feeding or touching sea turtles in U.S. waters is illegal under the Endangered Species Act. The author has engaged in certain practices for professional purposes that he would not undertake for a pleasure dive and does not recommend to other divers. ■



A green moray, seemingly amused by the antics of the intruders in wetsuits.

miles in every direction.

The navigational skills of sea turtles are both legendary and largely unexplained. It was certainly thought-provoking to see them vanish across this undersea “desert” in the morning and show up at the wreck again unerringly each evening, often after dark. A chance incident, however, gave me new respect for the unexpected abilities of a lesser inhabitant of this barren seascape.

We were about a mile from the wreck when Howard spied a large rock sticking up from the flat limestone like the proverbial sore

relationship would make an interesting story for the film. Nice mutualism: anemone gets chauffeur; crab gets bodyguard. I popped the crab into my BC pocket and brought it back to our boat, anchored over the wreck, and dropped it into a holding tank.

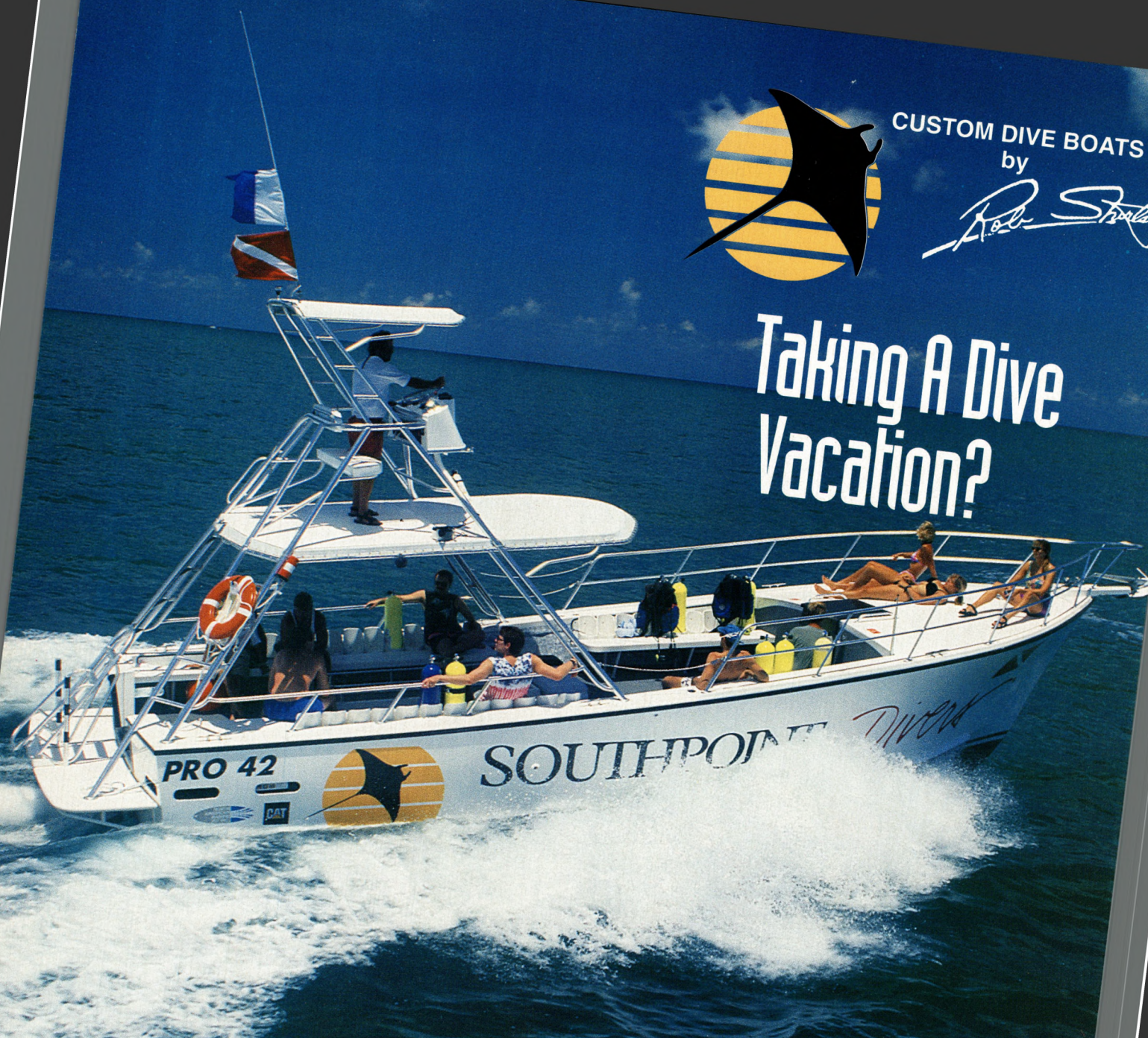
Howard, however, reminded me that he had a very nice crab-and-anemone sequence in his last film, and needed to do something different for this one. So that night, I took the crab down and, after taking a few photos for myself, released it on the wreck, thinking it would have more food and more



CUSTOM DIVE BOATS
by

Rob Shirley

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Rob Shirley

COMMENTS

I just returned from a great dive trip. We were in Cozumel & the people we were diving with just happened to be trying out a new boat and we were lucky enough to be on it – no propeller, what a great idea – we only did one dive but I can tell you – I was impressed, what a great dive boat. When I received my PADI Undersea Journal, I noticed your ad in it. I recognized that this was the boat we were on in Cozumel. I just wanted to send you a compliment. If I owned a dive operation, I'd have one.

Ed Peters
San Francisco, CA

On a recent trip to Little Cayman, I had the opportunity to go out on one of your Pro 42 Dive Boats based at Little Cayman Beach Resort. You must have put a lot of research into building that boat – I've been diving 25 years & I've never been on such a pleasurable dive boat. Everything is so well thought out. Lots of room; great seating & easy tank racks; the very best ladder I've ever used; and the safety factor of no propeller – wow – why doesn't every dive operator have one? And by the way, that Little Cayman Beach Resort provided me with the best dive vacation I've ever been on, & your boats are great.

Gene Smalley
Grand Rapids, MI

Dear Rob,

Just a note of appreciation. Thanks a million for providing our operation with 2 Pro 42 Dive Boats. We've got 400 hours on one and 600 hours on another and we've had nothing but pleasure from them. We constantly get compliments from customers and they are so easy to maintain. Our fuel consumption is averaging about 7 1/2 gph...unbelievable. You obviously knew what you were doing when you went with the jet drive – it's great. It will go in places we can't get to even with our dinghy.

I would like to point out that the most obvious advantage is the safety factor. This boat is built like a rock. As our operation grows, we'll buy another one.

Ed Morris
Little Cayman Beach Resort

To the Pro 42 guys,

Recently we had a group of divers that were diving with another dive operator here in Key West. They came in our shop and requested to charter with us only if they could get the new Pro 42 Dive Boat. They saw it out on the dive site the day before and got our name. This has to be the best testimonial. We got business from our competition, just because we have a Pro 42.

Thanks,

Ed Rusic
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PRESERVING

The Movement To Protect Palau's Spectacular Underwater Resources

BY YVETTE CARDOZA

It was early in our week of diving Palau, we were shallow and, frankly, the wall wasn't that spectacular. It took several minutes to realize what that nondescript bushy stuff at 30 feet was.

Black coral.

I could close my eyes and see the divemasters in the Caribbean getting all excited in recent years about the few sprigs of black coral still to be found at 100 feet. I could hear them talking about how rare it is.

And here we were, virtually at snorkeling depth

and wandering through forests of the stuff. So, despite the hordes of fish, parades of sharks and bizarre goodies such as lakes filled with stingless jellyfish, in the end, it was something far more mundane that made the point to me about what a treasure Palau is today.

The place is still so untouched that commercial gem shops haven't cleaned out the black coral.

From my 30 years of diving, I can recall when now-troubled areas in other parts of the world still contained abundant live coral, clouds of fish and consistent 200 foot visibility. And, yes, black coral.

PARADISE





(Previous page) An anemone fish nestles in its carpet-like habitat. (Inset) The clown triggerfish (*Balistapus comspicillum*) is just one of the exotic species to be found in Palau.

How many times have we heard that old lament: "You shoulda seen this place 20 years ago."

Well, 20 years ago — heck, 40 years ago — is today in Palau. And, thanks to hindsight and the luxury of having come on the scene well after other resort areas had made their errors, Palau is taking steps to make sure it stays more or less pristine.

THE GOOD STUFF

Because of weather problems, our week aboard the *Palau Aggressor* had started slowly. But when things finally settled, we hit the good stuff. Fast.

Late on our second day, we headed for a dive site called Ngemelis Drop Off. We had to go

snappers, sergeant majors, the occasional unicorn fish and below us, maybe 20 feet from our fins, a reef shark.

The fish weaved back and forth in strands, like some unbelievably large tapestry hanging against the rock wall.

UNDERWATER DIVERSITY

Mesmerized by the life around me, my mind wandered to recall recent conversations with Mary Ann Delemel and Chuck Cook. Mary Ann is managing director for the Palau Visitors Authority. Chuck is director of the Micronesia program for the Nature Conservancy, an environmental group working to save various endangered species.

"Before you understand what we're trying to do, you have to understand what Palau is," Mary Ann told me late one evening as

in Palau is 1,500 and it's growing almost monthly. According to Chuck, the biological diversity here is almost beyond comprehension. "The Caribbean, for instance, has only 69 species of hard coral. Palau has 400 and some 200 species of soft coral.

That fish count comes from eight studies done by the Nature Conservancy during its three years in Palau. "We had a marine team investigate 150 sites to identify species of coral, reef fish, invertebrates, sea grass and algae, and to get a feel for the conditions and diversity [of the environment] and to identify fish spawning sites and coral reef habitats," Chuck explained.

A SAVINGS PLAN

The report was finished in the fall of 1993 and given to the Palau government. The government, in turn, had just started work on a master plan. The plan will be a guide for economic development, conservation and environmental protection activities in Palau.

"We hope the committee will use this information to decide where economic development can occur and where it should not occur — how big it should be. This will help in deciding how intense resort development should be — where golf courses, bridges, roads and airports should and should not go," Chuck added.

On a more immediate level, there are the mooring buoys. In recent years, the increasing number of dive boats has led to reef damage by anchors. The Nature Conservancy helped identify 10 heavily used dive sites where 15 buoys have been installed for dive boat use.

There have been some problems with maintenance and ropes giving way when the largest boats try to tie up, but things are being worked out. Plans call for more rigorous maintenance and probable installation of stronger buoy systems for the larger boats.

Soft coral grew in clumps. There were branching sprigs of violet, purple, neon pink, blue and red.

in a small dive skiff, threading through the bulbous Rock Islands and skimming over shallow water that shimmered a mint-gel green.

The skiff stopped in 10 feet of water. Just yards away, the wall dropped like a rock to 800 feet. It was the straightest underwater edge I'd ever seen — straighter even than Bloody Bay Wall in Little Cayman.

Soft coral grew in clumps. There were branching sprigs of violet, purple, neon pink, blue and red. But all this was far overshadowed by the fish.

Schools of tropicals were everywhere, each group numbering from the hundreds to the thousands: pyramid butterflies with yellow triangles around a white core, square spot anthias whose iridescent pink bodies bore a huge purple patch, squirrel fish and

we sat in Chuck's dining room. Palau, she explained, is a 400-mile-long group of some 340 islands surrounded by a barrier reef. The archipelago is seven degrees north of the Equator, east of the Philippines and west of Guam.

The important thing, Mary Ann added, is that it sits where major ocean currents meet. Thus, there is a wealth of fish — a diversity, found in few other places.

In fact, the fish here are so spectacular that CEDAM, a marine conservation organization, has included Palau in its list of the seven underwater wonders of the world. (Along with the northern Red Sea, Australia's Great Barrier Reef, Deep Ocean Vents and Russia's Lake Baikal.)

The latest count on fish species



An incredible diversity of marine life earned Palau a place among the seven underwater wonders of the world.

FISH ON THE CORNER

Back aboard the *Aggressor*, our dive week was picking up steam. By Wednesday, the wind and swells had subsided somewhat, though it still looked like a rollercoaster at the primo dive sites. Nevertheless, it was far easier to manage safety stops in the swells and get back into the small skiff than we expected.

We were at Blue Corner, Palau's most famous dive site. It really is a corner, located on the tip of an underwater peninsula. The incoming tide hits the vertical wall, pushing nutrient-rich water to the surface. Small fish come to eat the microscopic goodies and large fish

come up from the depths to eat the small fish.

Schools of pelagic fish come in from the open ocean to eat the large fish and sharks come in to munch everything. As our divemaster put it, "Keep the wall on your right and the sharks on your left."

With this advice, we rolled backward into the water. And, wow!, the show started immediately. There, hardly 20 feet below, was a school of jacks. Not 20 or 30 but probably 1,000. Picture a thousand two-foot long fish packed together like sardines and all swimming in perfect unison. I tried to drop into them

but the stream bulged out of my way. We played this slow motion game of underwater tag all the way down to 130 feet.

Finally, I caught up and the jacks just flowed around me while two gray reef sharks came in from the side. The three of us did this graceful little ballet while the jacks swirled around us like some monster gray storm cloud. And then, just as quickly, the jacks were gone leaving me alone with the sharks.

The sharks, meanwhile, seemed to have their own agenda, looping and banking, sometimes coming so close that I could see the wrinkles on their pilotfish. It

says something when you're so close to a shark, you can't get the entire thing in the viewfinder of your video camera. Until that moment, I had never been close enough to discover that some shark eyes have slitted pupils like those of a cat.

A BALANCED PLAN

This is the kind of treasure the Palau government wants to preserve. "We understand the value of tourism," Mary Ann had said back in Chuck's dining room. Palau isn't Disneyland but growth has increased by a steady 10 to 20

percent each year for the past several years.

In 1992, 15,000 divers visited Palau — twice the total of five years ago. There are now 12 commercial dive operators and three live-aboard boats.

In Palau, economic money-

PALAU TRAVEL TIPS

It takes a little bit of effort to get half-way around the world, but it's worth it. A few simple suggestions can make your exotic excursion much more enjoyable.

BY RICK GAFFNEY

Yes, it is far away and yes, it is unquestionably worth it to travel all that way to dive Palau.

The Palau archipelago promises some of the most compelling dive experiences of a lifetime and the stress of any amount of travel is completely overcome by the quality of diving.

The options for accommodations and guides in Palau are varied, ranging from world class live-aboard dive boats and a five star resort to economy motels and price-competitive dive operators. We'll get to that in a minute, first let's get you to Palau.

The sole air carrier from Guam to the Republic of Palau is Continental Air Micronesia, a subsidiary of Continental

Airlines. Connections are excellent from any Continental hub city in America, through Honolulu and Guam. You can fly other carriers such as Northwest or JAL to Guam and all major carriers to Honolulu.

Flyers from the eastern corners of the country often prefer an overnight stop in Honolulu to cut the East-to-West flight stress. If you do, avoid tacky Honolulu airport hotels which are expensive and offer no restaurant or shopping options and instead take a shuttle to Waikiki (taxi fares are enormous). Enjoy all that's good about Waikiki — the "aloha spirit," creative cuisine, quality hotels at bargain prices, classic architecture, extraordinary scenery, great entertainment and that famous beach.

Some west coast divers prefer to make the long haul. Continental's connections through Guam are both timely and easy. If you consume copious amounts of water, avoid alcohol and adjust your body clock to Palau time en route, it's not that bad.

Palau's airport is atrocious. Customs and immigration formalities are tedious and an affront to most visitors' dignity, but relax, you're close now. Smile and make it easier on yourself and your fellow travellers because just past the customs officers some of the friendliest people in the Pacific are ready to get you underwater.

Once out the customs doors, you'll be greeted by representatives of most of the dive and hotel operators on Palau. If you don't have reservations (not recommended, but not a fatal mistake), these people will be able to tell you if they have room for you. Most accommodations are less than 30 minutes away in, or very near, Koror. As most flights arrive in the early evening, you'll be ready for bed. Go there immediately, do not pass Go (also known as the bar)! Dawn will unveil the beauty of Palau and you'll be ready to dive.

Live-aboard divers will be informed prior to arrival where and when they are to meet company representatives. If you overnight in a local hotel, do the boat crew a favor by not showing up early to see if you can 1) just leave your dive gear, 2) just set up your cameras or 3) just see your cabin. Give them time to clean the boat



The inspiring Rock Islands can be seen everyday on the way to your dive site.

makers boil down to tourism, agriculture and fishing with tourism leading the three. "But we don't want to push tourism to the expense of the other two sectors," Mary Ann said.

In other words, Palau doesn't want to become another Guam,

lined with highrise hotels and blanketed with golf courses. And those things, along with a much expanded airport, have been proposed.

Monster resorts have two dangers. A large resort on a small island can overwhelm the available

resources needed to supply and service that resort. In such cases, everything must be imported and the locals lose out. Equally important, Chuck added, is the soil erosion and overfishing that large scale development can bring.

Soil erosion can cloud water,



From luxury rooms to hostel-like accommodations, a variety of resorts are available in Palau.

from the previous charter and prepare for your arrival at the prearranged time. They have precious little time to accomplish these tasks and Palau's live-aboards are heavily booked.

The present options in live-aboards are the *Palau Agressor*, one of the most modern and best managed of the renowned Agressor Fleet, the *Palau Sport*, a 28 passenger dive vessel catering predominantly to Japanese divers, and the *Ocean Hunter*, a smaller motor-sailer of growing repute. And, you can look for one of Peter Hughes' super live-aboards in Palau by mid-1994. The original Palau live-aboard motor-sailer, *Sun Tamarind*, has been retired.

Divers staying ashore have many options, some of which tie directly to specific dive operators. Live-aboard divers have the benefit of missing the 50-minute run each way to most of Palau's premiere dive spots. However, the ride through the Rock Islands is so inspiring, it's easy to enjoy each day.

The island nation's high-end hotel operation is the exquisite Palau Pacific Resort, a world class resort with 100 spacious guest rooms and suites which look out over a sugar-sand beach across a massive lagoon at the famed Rock Islands. European cuisine with Pacific Rim flare, varied dining experiences nightly, superb entertainment and the friendliest, best

managed staff in Micronesia are just some of the attractions. Pricey? Yes, but you get everything you pay for.

The Palau Pacific Resort is also the base for one of the most professional dive operations in the Pacific — Splash. Located at the foot of the hotel wharf, Splash offers the most complete dive shop, modern equipment, the best equipped boats and some of the most professional staff in Palau.

American, Japanese and Palauan staff members cater to the special needs of individual divers and a pair of modern, custom dive boats — a twin water jet powered aluminum 45 footer and a 30-foot power catamaran — will whisk you to and from the famed walls, drop-offs and coral grottoes (yes, Jellyfish Lake too) in comfort and safety. Splash boats are among the very few in Palau with covered decks, camera rinse tanks and marine toilets.

All local dive operators will gladly pick you up every morning by boat at the Palau Pacific Resort wharf, and there is no pressure to dive with Splash just because you're staying at the PPR.

At last count, there were roughly a dozen competent dive operators in Palau, and that number will have grown by the time you read this. Many of those operators cater predominantly (if not exclusively) to Japanese divers and while they are very competent, language barriers and diving customs can make some of them harder to dive with. You could quickly find yourself wondering *kare wa nani o itte iruno desuka* (what did he say?). As a result, I won't discuss any of the dive operators that are not English language oriented.

One of the relatively new operators on the Palau diving scene has captured the loyalty of virtually everyone who has booked his dive tour services. U.S. born Sam Scott founded Sam's Tour Service after moving to Palau to be closer to his step-father, the High Chief of Koror.

continued on page 42

killing reefs. The problem with overfishing is obvious. And real.

Islanders catch fish and haul them to Guam where they sell the fish and buy delicacies not always available in Palau. I remembered the scene at the airport. A customs officer opened a returning

Palauan's huge styrofoam box and checked through tightly packed boxes of Rice Krispies. "Right now, Palau is providing almost half of the reef fish needed to feed the people and tourists of Guam and Saipan because their reefs are being destroyed," Chuck said.

But the Nature Conservancy isn't saying Palau should stop fishing or selling fish. "If you can close the spawning sites during spawning season and you can get

The lionfish is just one of the 1,500 fish species found in Palau.

Sam's specialty is personalized dive tours and his side trips into some of Palau's marine lakes are the highlight of any dive trip. Sam manages a low-key, yet full-service people-oriented dive operation with several boats.



Whether you stay at a topside hotel or on a live-aboard, the diving is spectacular.

FRANKLIN VOILA

Two of the oldest and best known dive operators in Palau are Francis Toribiong's Fish 'N' Fins, and Shallum and Mandy Etpison's Neco Marine. Both utilize a fleet of open boats and good equipment. Despite the high standards and long experience of their owners, their services occasionally suffer from dive guides that display all the enthusiasm of a veteran bus driver in the Bronx.

Both of these operators are highly regarded by many, but if they should fail to meet your standards, fear not. There are other options.

Fish 'N' Fins is directly associated with and adjacent to the Marina Hotel and dive boat boarding is particularly convenient at the Marina's front steps.

While comfortable, the Marina suffers from a good news/bad news situation that may be unique in the international hotel industry. The good news is that the excellent dining room hangs out over a broadwater looking directly at some absolutely stunning Rock Islands. The bad news is the view from many guest rooms is the Koror

town dump. If you're underwater all day anyway, that imperfection actually matters very little.

Options for economy accommodations include the 17 room D.W. Motel and the West Motels with some 50 rooms in three locations, including large condo-style rooms with kitchenettes. These places offer all the basic comforts at reasonable prices and most dive operators will pick you up and return you via mini bus so that transportation isn't an issue.

The Hotel Nikko Palau is another local anomaly. The hotel has a view that any resort operator would kill for. Perched on a hill overlooking an indescribably beautiful marine lake and Rock Islands, it is breathtaking and inspiring. Unfortunately, the hotel has little else to match either the awe-inspiring location or superb international reputation of the parent Japanese hotel company.

One other option is Johnny Kishigawa's hostel-like Carp Island Resort situated on a 3-acre Rock Island and just minutes by boat from the famed Ngemelis Wall and Blue Corner. The funky, camp-like accommodations range from a bunk house to individual "abai" bungalows which are rugged but adequate. The predominant customers are Japanese, but for many regulars who don't like live-aboards, being first and last on the dive sites makes this spot a top choice.

Johnny also runs a full service Koror-based dive operation called Palau Diving Center which caters to visitors staying in various Koror hotels. Stop-overs at Carp Island en route to the dive spots give you a chance to see the island and decide if the accommodations are appropriate for your needs.

Palau has a lot to offer and it has the best developed tourism program in Micronesia. Be sure to stop by and see the superb staff at the Palau Visitors Authority for direction, information and advice.

CONTACT INFORMATION

Palau Visitors Authority, P.O. Box 256
Koror, Rep. of Palau 96940
Phone: (680) 488-2793 or 488-1930
Fax: (680) 488-1453 or 488-1725

DIVE OPERATORS
Fish 'N' Fins, P.O. Box 142
Phone: (680) 488-2637
Fax: (680) 488-1725

Neco Marine, P.O. Box 129
Phone: (680) 488-1755
Fax: (680) 488-2880 or 488-3014

Sam's Tour Service, P.O. Box 428
Phone: (680) 488-1720
Fax: (680) 488-1471

Splash, P.O. Box 847
Phone: (680) 488-2600 ext. 4122
Fax: (680) 488-1601 or 488-1725

ACCOMMODATIONS
Carp Island Resort, P.O. Box 5
Phone: (680) 488-2978
Fax: (680) 488-1725

D.W. Motel, P.O. Box 738
Phone: (680) 488-2641
Fax: (680) 488-1725

Marina Hotel, P.O. Box 142
Phone: (680) 488-1786
Fax: (680) 488-1725 or 488-1070

Palau Pacific Resort, P.O. Box 308
Phone: (680) 488-2600
Fax: (680) 488-1601
or 488-1725

West Motels, P.O. Box 280
Phone: (680) 488-1780
Fax: (680) 488-1783



a sustainable harvest of some of the species, then I don't think there's any problem," he said.

This kind of advice is at the heart of what Chuck's group is doing in Palau. But the Nature Conservancy is better known on the U.S. mainland for buying land in its efforts to protect it.

"That's not our job here," Chuck said. "We have no desire or designs to buy property in a foreign country. When we work in a foreign country, we can't afford to have our own agenda. We have to find ways where we have mutual overlap with the objectives of the government and landowners in that country."

Chuck's people have been working, instead, to provide information that can be used by Palauans as they formulate an economic development plan. Specifically, the Nature Conservancy has singled out Ngeremeduu Bay and the Rock Islands for special concern.

ROCKS AND MANGROVES

Ngeremeduu Bay on the west side of Babeldaob (locally called The Big Island) is a huge mangrove bay. As Chuck explained it, "Forty four percent of Palau's mangroves are in this one bay and river system and half the mangrove crabs that come out of Palau come from here." Plus, there are crocodiles, manatees and breeding areas for Palau's hordes of tropical fish.

As for the Rock islands, when CEDAM was talking about wonders of the underwater world, it specifically had the Rock Islands in mind. This is where all those species of reef fish, soft and hard corals live.

One of our days aboard the *Aggressor* was spent cruising these weird, mushroom shaped clumps of coral. They sit in the south central part of the Palau archipelago and are the remains of ancient uplifted coral reefs.

Each island, no matter how small, was tufted on top with the



YVETTE CARDOZO

This Micronesian paradise boasts 400 varieties of hard coral and 200 varieties of soft coral.

thickest vegetation imaginable — palms and hardwoods so dense that the green mat blended into a velvet blur from only a few hundred yards off. The smaller islands were undercut — a combination of wave action and digestion by marine microbes. The

result was a deep recess like an upside-down shelf that extended back 30 or 40 feet.

In some places, an entire face of an island had fallen off, leaving a sheer edge of coral which had then eroded further until the whole side was a patchwork of rock threads and crevices. And woven among these lines were bushes and trees.

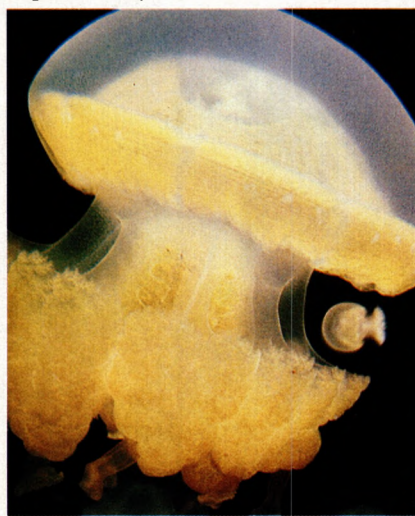
Magically, whenever we glanced at all this, a flock of white birds would fly by, highlighted by the sun and accented by the shadows of the rock. Travel posters are made of lesser scenes than this, and we could truly understand the urgent need to protect the area.

JELLY WATER

The Rock Islands are also home to Jellyfish Lake.

Talk about weird.

When the Rock Islands rose, some 80 large lakes were cut off



JUDI BROOKS

Jellyfish Lake harbors thousands of these stingless creatures.



from the sea. In this one lake, the resident jellyfish lost their need for stinging tentacles because there were no predators and symbiotic algae provided their food. So on one of the dive week's last days, when everyone's bodies were screaming for a rest from nitrogen, the group visited the jellyfish.

Jellyfish Lake is a true mangrove lake, complete with hanging vines and cypress knees sticking out of the water. The pond is a muddy olive with five-foot visibility. But that murkiness only added to the surreal quality of our experience.

First there was one lone jellyfish — peach colored and translucent with a white filigree of gonads visible just under the cap. Then there were two, then three, then six, a dozen and suddenly, the water was milky with them.

At first, I thought the milk was kicked up silt, but it was just the sheer concentration. Some jellies were the size of a thimble, some were bigger than my palm. And

they all pulsed at different speeds — the small ones fast, the large ones slow.

The overall sensation was one of disjointed vibration. Finally, there were so many of them, the pulsing merged into a single froth. It was like swimming through giant champagne bubbles gone absolutely mad.

As we cut through this, the velvet jellies bumped our dive masks and bounced off our lips. They slid under our arms and between our legs. It was partly sensual and partly a giggle and none of us could figure which part was larger.

According to the Nature Conservancy report, less than half the 80 known limestone lakes in the Rock Islands have been examined. Who knows what's sitting in the rest of them.

PARADISE SAVED?

With its tremendous biological diversity and scenic treasures, there are many reasons why Palau wants to preserve its natural resources. The Nature Conservancy is trying to help by providing behind the scenes scientific information. Locals are forming committees, expressing their fears and making their recommendations. The master economic development plan is now being formulated.

In the years ahead, it remains to be seen whether internal needs and outside economic pressures will overwhelm present desires. Simply realizing the potential threats and taking early action gives Palau a big head start in the preservation process.

And, given the spectacular and singular nature of the area's underwater riches, this is good news for divers and anyone else who places a high value on the abundant life and beauty of the unspoiled underwater world. ■

Yvette Cardozo is a veteran travel writer and regular contributor to Sport Diver.

LIVE-ABOARD LIFE IN PALAU: JUST THE FACTS

The best diving weather in Palau occurs from December through March, when the wind blows from the northeast and the major dive sites are in the lee of the islands. Other times of the year, live-aboards have to anchor in protected coves on the other side of the islands and send divers across on small boats. The rainiest time of year is mid-summer.

Diving in Palau is not for the novice. When the wind blows onto dive sites, you have to deal with heavy swells. Stiff year-round currents turn most dives into drift dives, meaning you have to do safety stops in open water without the luxury of hanging on to the prop or the line of a larger, anchored dive boat. These same currents are also unpredictable. They can wash you up or down 30 feet in mere seconds. Competent buoyancy control is a must.

Water temperature in Palau hovers in the low to mid 80s, meaning lycra skin suits or, at most, Darlexx, will be sufficient. Ashore, it's hot and humid. Shorts, tank tops and sandals will do for most situations. Bring sturdier shoes if you plan to wander through old World War II ruins.

Palau is the last U.S. Trust Territory of the Pacific Islands and is currently working towards a Free Association status with the U.S. Visitors must bring proof of citizenship such as a passport. The local currency is the U.S. dollar and major credit cards are accepted.

The main town of Palau is Koror, a picturesque collection of shops and small houses. The best place in Palau to buy storyboards (island legends intricately carved across slabs of mahogany) is, believe it or not, the local jail. The jail gift shop is open 8 a.m. to 3 p.m. daily.

A week aboard the *Palau Aggressor* is \$1,995 and covers lodging, all meals, guided dives and heavy gear (tanks and weights). For more information on live-aboard diving, contact Aggressor Fleet, PO Drawer K, Morgan City, LA 70381, or call toll free (800) 348-0817. — Yvette Cardozo

0600 hours — Gear is secured and the vessel is cast off. After a four-hour cruise in rough seas, the objective is located and the anchor dropped. Dive teams recheck gear and recalculate gas management and decompression formulas before staggering across the heaving deck and plunging overboard.

WRECKING CREWS

Their mission: to fight their way down 200 feet against a two-knot current, locate a submerged vessel in low visibility, then enter it's decaying interior to retrieve small objects buried in layers of fine silt.

If this were a military exercise, the participants would probably get hazardous-duty pay. But it's not. These divers are amateurs and they consider this a sport. They are accustomed to such conditions, and have spent a lot of time and money to be subjected to this demanding and sometimes cruel environment.

Welcome to the world of wreck

diving. And while not all wreck diving scenarios are as "hard core" or "macho" as the one described above, they often involve diving practices and conditions outside the accepted limits of recreational training.

There are many levels of wreck diving between a first-time visit to stripped-and-sunk artificial reef and a mixed-gas exploration like the one described above. Collectively, they represent a diving specialty that becomes increasingly complex as depth increases and dive plans include penetration, decompression and visits to "natural" wrecks.

BY CAPTAIN BRET C. GILLIAM



BRET GILLIAM



WRECK TYPES

Submerged shipwrecks hold a special place in our collective imaginations. The general public has a romantic image of the sunken treasure ship sitting upright on her keel with tattered sails still creaking in the current and brass-bound chests straining with booty. Reality, however, is less dramatic.

The classic 16th and 17th century vessels sailing to the New World laden with riches were, of course, of wooden construction. But once sunk, they quickly deteriorated due to wave action and other natural elements such as destructive marine teredo worms which fed on the primary wood structure.

Those who have been successful in locating and salvaging these vessels have usually spent years researching logs and voyage records to determine the wreck location. Since the wrecks themselves were long buried under sand or coral there was typically no evidence to the divers' naked eye of a lost vessel. Tedious excavation of tons of sand, sediment, and debris was necessary before any cargo could be accessed.

As dive sites, these older ships offer little in the way of interest unless one is a committed treasure hunter with a considerable war chest of funding. Even then, the odds of success are better in the state lottery.

Although some modern wooden ships are remarkably well preserved in fresh water environments such as the Great Lakes, as a general rule, it is the steel vessels that provide divers with the most intriguing wreck diving opportunities. These ships are better able to withstand the ravages of time and in many cases can survive over a hundred years of entombment while remaining virtually intact.

A classic example is the wreck of the *Royal Mail Steamer Rhone*, which sunk in 1867 off Salt Island in the British Virgin Islands. Although

A well-equipped, self-contained deep diver stands ready to take the plunge. The extra tanks hold nitrox and oxygen for decompression

her stern section sank in 15 to 45 feet of water and has been largely reduced to rubble and scattered wreckage by over 125 years of pounding surf and currents, her massive bow section (nearly 200 feet long) remains fully intact in 90 foot depths resting on her starboard side. The *Rhone* has become the most popular wreck dive in the eastern Caribbean and much of the movie *The Deep* was shot using her remains as a natural set.

The east coast of the United States has been blessed with a wide variety of wrecks that have remained accessible, thanks to the offshore continental shelf which provides depths of less than 300 feet even thirty miles or more offshore. A proverbial grab bag of ages, types, sizes and "degrees of difficulty" are offered to divers of all levels from Key West, Florida, to Eastport, Maine. Some of the best sites resulted from sinkings during the two World Wars when many a tanker, freighter or war ship fell victim to submarine attack. Others such as the *Andrea Doria* came to an untimely end for other reasons.

CONTROLLING PHYSIOLOGICAL HAZARDS

Obsession or avocation, wreck diving is one of sport's most popular activities and the list for available sites is expanding every year. The wreck diving community can be divided into two distinct groups: those divers who utilize conventional scuba equipment and limit themselves to no-decompression exposures in 130 feet of water or less; and those who are

earnestly venturing to deeper depths requiring planned decompression and a variety of specialized gear.

These individuals are part of a group that has recently been labeled as "technical divers" to indicate their involvement in diving practices which extend beyond those of the traditional "recreational" diving enthusiast. Sometimes this distinction can be a bit blurry in practice, since both groups are essentially diving for fun, but the technical diving group approaches many of the increased hazards of depth and longer bottom times from a decidedly more, well...technical perspective.

Depth poses two compelling problems that must be dealt with responsibly: narcosis and oxygen toxicity.

Let's take a closer look at some of the challenges that a diver faces as he plans deeper explorations.

THE NARCOSIS FACTOR

Narcosis is not much of a problem for experienced divers at depths down to 130 feet or so. But as deeper dives are made, considerations for narcosis impairment have to be factored into the dive

plan. When breathing compressed air at depth, the increased nitrogen levels tend to produce observable deficits in judgment, cognitive function, memory and reaction times.

These effects vary widely in individual divers and can be further skewed by the influence of cold water, fatigue, and elevated carbon dioxide levels from the exertion of swimming or hard work. Some divers have found that their own susceptibility to narcosis will vary from dive to dive. Many divers also discovered that a certain adaptation to nitrogen narcosis is achieved by frequent exposure to deeper depths. Nonetheless, all divers will eventually reach a point of diminishing returns while diving compressed air.

For experienced deep divers, the prudent cut-off for compressed air dives will occur between about 180 and 220 feet. These are by no means magic numbers, but they do serve as reasonable guidelines.

As a result, the technical diver has borrowed some breathing gas technology from the Navy and commercial operations to control and limit narcosis hazards. This involves switching from standard compressed air, which is 79 percent nitrogen, and instead employing a trimix gas comprised of oxygen, nitrogen and helium. This mixture has several benefits.

Firstly, helium has a much lower narcotic potency than nitrogen, with a resulting reduction in the severity of narcosis effects at depth. Typical trimix blends will involve helium in the range of 17 to 50 percent. This allows the diver to manage his nar-

THE ANDREA DORIA: AN ONGOING OBSESSION

In 1956, Peter Gimble called a *LIFE* magazine editor to see if they would be interested in underwater photos of the ocean liner which had sunk off Nantucket Shoals following a collision with another ship only the day before. Assured that *LIFE* would purchase any such photos that Gimble could produce, he and Joseph Fox hired a plane and flew to Nantucket where, after considerable difficulty, they were able to charter a local boat to go out to the wreck site.

The *Andrea Doria* was a massive ship, 700 feet in length and displacing almost 30,000 tons. She settled on her starboard side in approximately 250 feet of water. This afforded access to her port side beginning in 160 feet. Gimble used the standard equipment of his day: double tanks and a double hose regulator with no cylinder pressure gauges. Rubber suits over woolen underwear served as thermal protection in the cool northeast water.

Less than 24 hours after her fatal plunge, the ship was still gleaming white as the two divers dropped onto her port rail. Gimble began working with a housed 35 mm Leica camera and had fired off only eight frames before Fox suffered dramatic incapacitation from carbon dioxide build-up. Reacting to his signal, Gimble abandoned his photography efforts and assisted his sickened buddy to



BRET GILLMAN

Overhead environments present unique hazards that require redundant equipment and specialized training and techniques.

cosis exposure precisely, even to the point of virtually eliminating the risk.

Secondly, helium is less dense than nitrogen and is therefore easier to breathe through a regulator at deeper depths. Finally, the hazards of breathing high partial pressures

of oxygen can also be controlled within tolerable limits.

OXYGEN LIMITS

Oxygen is not a problem within the scope of normal recreational diving. But as the diver

moves deeper, the partial pressure of oxygen increases until it can become extremely hazardous at depths beyond 220 feet. The most dangerous reaction to oxygen in these ranges can be convulsions which may cause the diver to lose his mouthpiece and drown.

There are published guidelines for oxygen exposures available from NOAA and these represent reasonable times for different partial pressures. Their current maximum recommended dose is 1.6 ATA (atmospheres absolute) for 45 minutes on a single dive.

For those of you not comfortable thinking in ATA, that is equivalent to 218 feet while breathing compressed air. By slightly reducing the oxygen content in the mixture from air's natural percentage of 21, a trimix diver can dive deeper without subjecting himself to elevated oxygen pressures. This is especially important in the often difficult environment of wreck diving, where increased exertion levels cause some diver's real-world oxygen tolerances to fall short of the general NOAA guidelines.

The advantages of trimix can be considerable, but there is a trade-off in increased decompression times for typical dives of 45 minutes bottom time or less. There is also a far stricter need to observe correct ascent rates and deeper deco stops, and a more equipment-intensive gear package necessitated by at least two gas switches during the ascent/deco phase.

Trimix also costs considerably more than compressed air (around \$50 to fill a set of doubles), and, of course, the diver will need to seek

the surface where he swiftly recovered.

His dive had not been in vain however; the black and white Tri-X film pushed to 1000 ASA by the lab yielded usable shots and Gimble had his exclusive with *LIFE*. Thus was born a lifelong passion for him with the *Doria*.

Gimble would return to the site repeatedly over the years. At the age of 52 in 1981 he mounted an expedition to recover the Bank of Rome safe from the First Class foyer. With 33 days on site, and use of both scuba and saturation divers he successfully recovered the prize.

For dramatic effect, the safe was then dropped into the shark tank of the New York Aquarium, where it remained for the next three years. On August 16, 1984 the safe was finally opened before an expectant international television audience.

Much speculation had centered on the safe's contents. Would it contain the riches in personal valuables, jewelry and gold that had fueled rumors for twenty five years? Gimble's worst nightmare was that it might simply be empty.

But as the door swung open finally, the safe revealed a mother lode of U.S. and Italian currency still neatly bundled in rubber bands. Although no gold bars were found, Gimble's monetary haul had considerable souvenir value.

The thousands of bills, each etched by the sea's destructive influence, were marketed encased in plastic mounts with certificates of authenticity. The proceeds did not cover the 1.5 million dollar expedition cost but to Gimble the reward was adequate. He had accomplished what scores of others had attempted in vain.

out specialized training and gain supervised experience for this new technology. It can be a substantial investment in time and money, but for the serious wreck diver considering diving in the plus-200 foot range, it's money well spent.

divers should always carry at least one sharp knife and a pair of high grade wire cutters in an easily accessible spot on the upper body.

The wrecks themselves have features such as electrical wiring, conduit and old ship's rigging that

getting lost in what may be a very large and unfamiliar place. Fine sediments, particles, even paint chips can be stirred up and quickly reduce visibility to a matter of inches. This is bothersome enough when you're in open water conditions, but inside an enclosed compartment, the loss of visibility can blind a diver and obscure the way to the safe exit and an avenue of escape.

DEALING WITH SILT

Silting is most often caused by careless finning techniques which stir up the materials that have settled to the bottom. The alert diver is cautious to adopt a modified "cave kick" or sculling fin stroke that keeps the backwash of the kick above the floor. Experienced divers with good buoyancy control and practiced finning techniques can traverse a wreck interior with minimal disturbance.

However, some wrecks will produce silt no matter what fin stroke is used. These have fine silt particles that cling to the overhead and compartment bulkheads. The diver's exhaust bubbles loosen the particles and an underwater snowstorm results. This can be just as dangerous as kicking up the bottom. Safety conscious wreck divers never venture into an unknown compartment without first observing the area for silt hazards. A moment spent studying the effects of fin kicks and/or bubbles can quickly alert the dive team to what may be an unsafe area.



This diver carries all necessary decompression gas on his person, and will be able to perform the required stops safely even if separated from the anchor line.

NATURAL HAZARDS

Other hazards must be considered when diving around wrecks. One of the most significant potential hazards is entanglement from accumulated fishing line, wire leaders and the like. Remember, fish like to live in wrecks and fishermen know that.

Popular wreck sites can become festooned with various fishing lines like a Christmas tree with tinsel. To deal with entanglement, wreck

seem to reach out and snag the passing diver. Increasingly, the hazard of trawls and nets that snag into the wreck can present entanglement scenarios. Experienced divers respect the potential hazards of the wreck environment and proceed with caution at all times.

Those involved in penetration diving — entering the wreck to explore the interior sections — must be careful to plan for two other insidious dangers: silting and simply

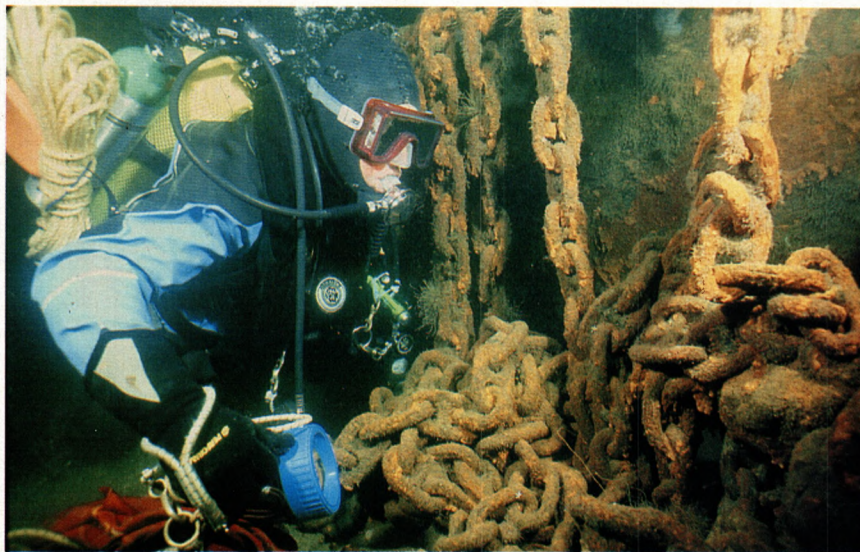
PENETRATION PRINCIPLES

There are two schools of thought when it comes to dealing with wreck penetrations and the possibility of getting lost inside.

In the northeast, the practice of "progressive penetration" has gained acceptance with a large number of wreck enthusiasts. This method required the discipline to gradually penetrate a wreck while memorizing its landmarks, hallways, ladders and exits. This has worked well for some divers particularly those who made a practice of poring over ship plans and blueprints

before aggressive excursions.

Another approach has been to adopt the use of reels similar to those used in cave diving. This method allows for recovery from virtually any unexpected scenario since a continuous guideline to the wreck's exterior is maintained.



Wreck divers must learn to recognize and avoid or overcome such hazards as silt and deteriorating structure.

As wrecks get older, they can be significantly affected by the sea's natural weakening of the structure. This can lead to "break downs" of interior compartments, standing masts, rigging and deck hardware. Penetration divers must pay close attention to a structure's potential for failure prior to swimming under or through such areas.

Wrecks that have been sunk deliberately usually have been initially stripped of the most obvious hazards. Sometimes, large access holes are also cut into the hull to allow easier access and to provide more avenues of natural light to interior areas. Extraneous equipment, wiring, and hatch covers or doors are frequently removed to prevent future problems. Be aware of what kind of wreck site you are diving, as natural wrecks will not be so cosmetically attended.

TRAINING AND SAFETY

The imperative for proper training should stand foremost in any diver's mind before

attempting all but the most basic wreck diving. Specialty programs are available from every recreational certification agency such as NAUI, PADI, and SSI.

More advanced and technical training can be obtained through instructors from the International

greater majority of such deaths have been attributable to either a lack of training or diver errors (such as deliberately exceeding accepted oxygen limits, improper monitoring of gas supply resulting in running out of air, or becoming lost inside the wreck).

An investment in proper training and the observation of a few common sense safety guidelines will allow divers to explore the fascinating world of sunken wrecks with an acceptable degree of risk. Just remember to crawl a little before you try to walk.

Wreck diving is one of the most exciting and challenging niches in our sport. Tens of thousands participate safely in various explorations each week. Seek out a reputable dive operation or dive boat for your entry-level experiences and make good use of their local knowledge and advice. You'll be rewarded with unique marine life encounters, excellent photo opportunities and a chance to explore a piece of history that only divers can witness. 

Association of Nitrox and Technical Diving (IANTD). Their members are available internationally and offer insured curriculums in nitrox, deep air and trimix diving for wreck environments.

A few headline-grabbing fatalities have occurred in recent years on wrecks, but upon close examination of the accident circumstances, the

Bret Gilliam is president of Ocean Tech and actively involved in technical diving training. He is a 23 year veteran of the professional dive industry with over 13,000 logged dives. He is author of seven books including Deep Diving and Mixed Gas Diving and serves as Vice Chairman of NAUI's Board of Directors and Vice President of IANTD.

SURPLUS SINKINGS

Today divers are not limited just to "natural" wrecks. The popularity of creating artificial reefs by using surplus naval vessels and ships that have outlived their commercial usefulness is increasing. In the fall of 1993, the city of Miami even sponsored a commercial jet airliner as the latest addition to the scores of deliberately placed wrecks off the south Florida coastline.

Originally, the push for artificial reef projects was fueled by fishing interests. Charter fishing captains had known for years the value of wrecks to attract and become home to resident fish populations. As divers began to visit these same sites, a dual use was realized.

Recently, wrecks that were placed beyond the 130-foot depth level have come under closer scrutiny by the growing cadre of technical wreck divers.

In Key West, the massive light cruiser *Wilkes Barre* beckons experienced divers, her decks still bristling with heavy guns and other naval armaments. She can be dived within compressed air limits on certain sections, but requires special breathing mixtures to safely explore the entire wreck.

Up the coast in Pompano Beach, a series of deep wrecks all located within minutes of each other offer some of the best diving in the U.S. for those divers with appropriate equipment and training.

BY PAT CANOVA

Sanctuary

P U T T I N G
O U R O C E A N S
I N F E D E R A L
C U S T O D Y

On a warm August evening in 1984, a 470-foot behemoth named *Wellwood* plows off course, blindly knifing through the shallow waters off Key Largo, grinding and pulverizing the coral reef below its hull. The ship knocks over huge, several-hundred-year-old brain and star corals, sending a multitude of marine creatures scurrying out of the juggernaut's path.

The captain, realizing too late that something





JOHN SPAGNOLO ASSOCIATES

This wrasse blenny has found its own form of sanctuary at Looe Key National Marine Sanctuary.

NATIONAL MARINE SANCTUARIES

Though many of our marine sanctuaries allow scuba diving, not every site lends itself to casual underwater exploration by the average sport diver. The most popular dive destination far and away is the Florida Keys National Marine Sanctuary, though our western areas off the California coast are hot on the heels of the Keys and can offer some exquisite diving.

Diver education is one of NOAA's priorities and they have been closely working with organizations such as NAUI and PADI to make divers more aware of how they should be diving around sensitive areas such as coral reefs.

CHANNEL ISLANDS NMS

Designated a marine sanctuary in 1980, these unique islands lie approximately 20 miles off the coast of California at Santa Barbara. Five islands comprise the sanctuary: Anacapa, Santa Rosa, Santa Cruz, San Miguel and Santa Barbara. Each island has special regulations for use coinciding with the National Park system and the California Department of Fish and Game.

Generally, scuba diving is permitted and the cool waters offer a rich array of plant and animal life. Forests of giant kelp are home to a teeming variety of



fish and invertebrates. In addition to seals and sea otters, over 27 species of whales and dolphins frequent the Channel Islands waters throughout the year.

Channel Islands NMS

113 Harbor Way

Santa Barbara, CA 93109

(805) 966-7107

LCDR John A. Miller, Manager



From large marine creatures to small ones like these red night shrimp, the Key Largo National Marine Sanctuary established in 1975 is home to a diversity of life.

has gone wrong, throws the engines in reverse, but the ship keeps going — its momentum carrying it onto the top of Molasses Reef. The crew's efforts to extricate the ship are futile and *Wellwood* flattens large tracts of the fragile reef, leaving it, in places, as smooth as a parking lot.

The grounding of the freighter *Wellwood* and three subsequent groundings in October 1989 played a major role in prompting Congress in 1990 to designate all the waters of the Florida Keys a national marine sanctuary.

While most of man's inadvertent assaults on the underwater environment have not been as dramatic as *Wellwood's*, no one can argue that our impact has been sig-

nificant and, in some cases, devastating. From divers and snorkelers who casually brush up against delicate corals to sewage outfall, from anchor and boat damage to the hazards of oil and gas exploration, there are too many ways to wreak havoc on our underwater world.

And there are natural disasters such as hurricanes and climate changes that compound the risks to the marine environment. More than any other group of people, divers see the effects of these assaults on the delicate balance of nature's underwater realm. Fortunately, they're not alone in wanting to preserve and protect our oceans from further harm.

Questions of how well sanctuaries protect our underwater envi-



DOUG FERRINE

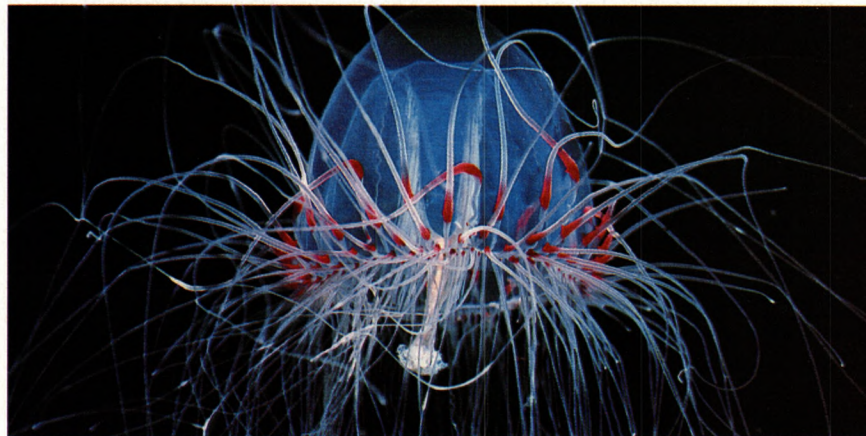
ronment and the cost in terms of money and increased regulation are topics of heated debate even among the experts. The fact that Key Largo was already a designated sanctuary when the *Wellwood* plowed into Molasses Reef did little to alleviate the destruction.

THE SANCTUARIES PROGRAM

Established in 1972, the National Marine Sanctuary Program consists of 13 marine sanctuaries administered by the National Oceanic and Atmospheric Administration (NOAA). The goals of the sanctuary program are "...To identify areas of the marine environment of special national significance due to their resource or human-use values...To coordinate conservation and management of these marine areas with existing regulatory authorities...To support and promote scientific research...To enhance public awareness...To facilitate all public and private uses of the resources not prohibited."

Ranging from a tiny one-mile-wide area that contains the resting site of the Civil War ironclad, *USS Monitor*, to the 4,000-square-nautical-miles that comprise Monterey Bay National Marine Sanctuary, our sanctuaries harbor an amazing assortment of diverse marine habitats. From great whales to comical sea otters, all kinds of sealife roam their protected waters.

They encompass the third largest barrier reef system in the world (the Florida Keys) and include some of North America's richest fishing grounds, as well as some of the most desirable boating and diving locales. Stressing research and public education along with protection, each sanctuary management plan is tailored to fit the needs of the individual preserve.



MARK CONLIN

This polyorchis jellyfish was spotted on a night dive near Anacapa Island.

NATIONAL MARINE SANCTUARIES

CORDELL BANK NMS

This unique corner of the California Continental Shelf has been a marine sanctuary since 1989. About 20 miles due west of Point Reyes, Cordell Bank rises up from a 6,000-foot depth to form an underwater "island" at 115 feet.

A little over 9 miles long by approximately 5 miles wide, the Bank harbors an incredible variety and density of marine invertebrates and species of fish. Diving here is not for the fainthearted as depths and currents combine to make it a very risky proposition.

Cordell Bank NMS
Fort Mason
Building #201
San Francisco, CA 94123
(415) 556-3509
Edward Ueber, Manager

GULF OF THE FARALLONES NMS

This large sanctuary embraces 948-square-nautical-miles of wild and lusty California coastline north and west of San Francisco. Designated in 1981, the sanctuary, which includes the rugged Farallone Islands, provides a protected habitat for a variety of marine mammals and seabirds.

This is a powerful ocean environment, full of gusting winds and rich ocean currents. The region was long a favorite hunting ground for seals, sea lions and sea otters, and now is home to California's largest population of breeding harbor seals. Literally millions of seabirds thrive in the rugged terrain found in the sanctuary and its waters swarm with whales and dolphins throughout the year.

Although scuba diving is not prohibited, these beautiful but cold waters are not considered an ideal place to dive due mainly to the presence of great white sharks and other predators that feed upon the seal population of the area.

Gulf of the Farallones NMS
(shared with the Cordell Bank)
Fort Mason, Building #201
San Francisco, CA 94123
(415) 556-3509
Edward Ueber, Manager

MONTEREY BAY NMS

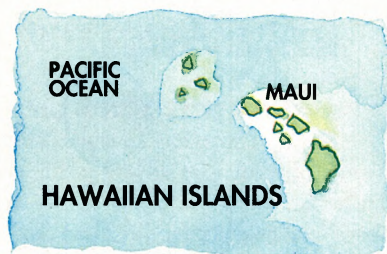
Dedicated in September of 1992, this is the largest of our marine sanctuaries. Encompassing more than 300 miles of California coastline from San Francisco down to San Simeon, Monterey Bay sanctuary has as rich a variety of marine habitats as

NATIONAL MARINE SANCTUARIES

down to San Simeon, Monterey Bay sanctuary has as rich a variety of marine habitats as anywhere on earth.

An immense underwater abyssal canyon located just offshore provides a mammoth upwelling of nutrient-rich seawater that feeds everything from whales to lushly forested giant kelp gardens to the tiniest of marine invertebrates. These cold waters have long been a favorite of scuba divers exploring the bays and rugged coastlines, and especially the cathedral-like kelp forests around the Monterey Peninsula.

Monterey Bay NMS
2560 Garden Road #101
Monterey, CA 93940
(408) 647-4208
CDR Terry Jackson, Manager



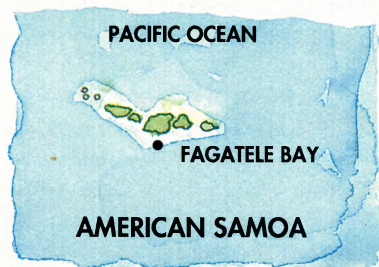
HAWAIIAN ISLANDS HUMPBACK WHALE NMS

One of our newest 1993 designees, this sanctuary is located just off the island of Maui in Hawaii. The site is a favorite haunt of whales and other marine mammals and whale watching is a popular pastime here in the waters between the two islands which are a major breeding ground for the huge humpbacks.

Hawaiian Isl. Humpback Whale NMS
300 Ala Moana Blvd., Room 5350
P.O. Box 50186
Honolulu, HI 96850
(808) 541-3184
Janice Sessing, Sanctuary Liaison

FAGATELE BAY NMS

Located in American Samoa, Fagatele (pronounced, Fang-a-teh-leh) is a semicircular, eroded volcanic crater on



"It's a lot more complicated than running land-based parks," says Francesca Cava, chief of the Sanctuaries and Reserve Division of NOAA. "We don't know as much about how to manage a marine environment as we do about the land. We're very much in our formative years and still learning as we go. In addition, we have not only our sanctuary regulations, but all other regulations that apply to the marine environment — the Endangered Species Act, a stack of abandoned shipwreck acts, and various laws that apply to archaeological and historical resources."

EXPANSION PLANS

It has been suggested by some that the sanctuaries program might be biting off more than it can chew with the recent designations of mammoth sanctuaries in Monterey Bay and the Florida Keys, not to mention Stellwagen Bank off Massachusetts and the Hawaiian Islands Humpback Whale Sanctuary.

Cava says that even though there are problems, she thinks they can be worked out. "We've grown very quickly and any program that grows quickly has its growing pains. NOAA feels that this is an opportune time for the program. Many of the great land parks were created before real demand for the land was apparent — as it is today. I don't think we could have a Yosemite or Grand Canyon if the government tried to establish them today. In much the same way, there's a feeling that the marine environment is undervalued now, but that will change in years to come."

Citing a recent trip to post-war Kuwait where she went diving on damaged reefs, Cava feels that we really can't wait until the system is damaged to acquire the property. "Just as on land, it's much easier to prevent problems before they occur than to fix things later. That's what the sanctuary program is all about. Some of these areas are still very new to use. Perhaps only in the last

20 years or so have they been impacted by man."

Funding has been a chronic problem with the program from the beginning. The U.S. Congress funds the program for only five years at a time, leaving it vulnerable to the state of the economy and changing budgetary priorities. But sanctuary staff, working side-by-side and sharing personnel and resources with local, state and other federal agencies, have managed to keep the programs going.

Robert Feingold, a program specialist with the recently designated Florida Keys National Marine Sanctuary, says, "Our program is successful because we work through cooperative agreement. NOAA, by themselves and with their budget, couldn't handle it. By entering into agreements with the State of Florida, the Coast Guard, the U.S. Fish and Wildlife Service, and Monroe County, we can expand and get more for our money."

THE FLORIDA KEYS SANCTUARY

Because of the early success of both Key Largo and Looe Key Marine Sanctuaries, the Florida Keys National Marine Sanctuary (which now technically encompasses the other two) has a head start on developing an overall management program for their very complex situation. Lessons learned in working with the Florida community will be helpful in the management of other sanctuaries.

Designated by Congress in 1990, the Florida Keys sanctuary is presently holding hearings and gathering input from the public. Bill Goodwin, assistant manager of Key Largo sanctuary, puts it this way: "People know us up here (the upper Keys) — they're familiar with what we do because we've been here since the late Seventies. We have a good rapport with the dive shops, charter boat people

A goldspot eel peeks out of the brain coral at Looe Key NMS.



KIM STANBERRY

NATIONAL MARINE SANCTUARIES

the island of Tutuila. In this small bay is a fringing reef system containing almost 200 species of coral.

Designated a marine sanctuary in 1986, it is now recovering from a major infestation of crown-of-thorns starfish that occurred 10 years ago. Diving and snorkeling are encouraged in this, the only true tropical reef in the National Marine Sanctuary Program.

Fagatele Bay NMS

P.O. Box 4318

Pago Pago, American Samoa 96799
(684) 633-5155

Nancy Daschbach, Coordinator

FLOWER GARDEN BANKS NMS

These are a pair of underwater coral reefs situated approximately 100 miles off the coast of Texas in the Gulf of Mexico. Lying at 50 feet below the surface, the Gardens are the northernmost coral reefs on the continental shelf of North America.

Designated in 1992, the Gardens encompass 41.7 square miles. Turn-of-the-century fishermen who frequented the fertile fishing grounds of the banks, gave them their name after hauling up colorful bits and pieces of corals and plant life in their fishing gear.

An oasis of Caribbean reef life, the Gardens are a haven for tropical



corals, fish, lobster, rays and even loggerhead turtles and dolphins. Scuba diving is an overnight proposition due to long distances covered, and dive boats are available out of both Texas and Louisiana.

Flower Garden Banks NMS

C/O Texas A&M, Sea Grant Program

NATIONAL MARINE SANCTUARIES

1716 Briarcrest Drive, Suite 702
Bryant, TX 77802
(409) 847-9296
Dr. Steve Gittings, Manager

KEY LARGO NMS

Designated in 1975, Key Largo National Marine Sanctuary was one of our first marine sanctuaries and is probably the most visited and popular (certainly in the eyes of divers) in the whole sanctuary system. Shielded and protected by the island of Key Largo, the coral reefs in the sanctuary survive in spite of the pressures of civilization.



Beautiful stands of staghorn, elkhorn, brain and star corals are home to a dazzling array of tropical fish and colorful invertebrates. A nine-foot tall underwater bronze statue, "Christ of the Deep" beckons divers into the underwater gardens of this sanctuary.

Mooring buoys at the most popular dive sites are convenient, and help protect the fragile coral formations from anchor damage.

Key Largo NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644
CDR Alan Bunn, Manager

LOOE KEY NMS

Looe Key sanctuary is small, but packs a lot into its 5.3 square miles. Located three miles off Big Pine Key in the lower Florida Keys, Looe Key was designated a sanctuary in 1981. It is considered one of the finest examples of "spur-and-groove" reef formations in the world.

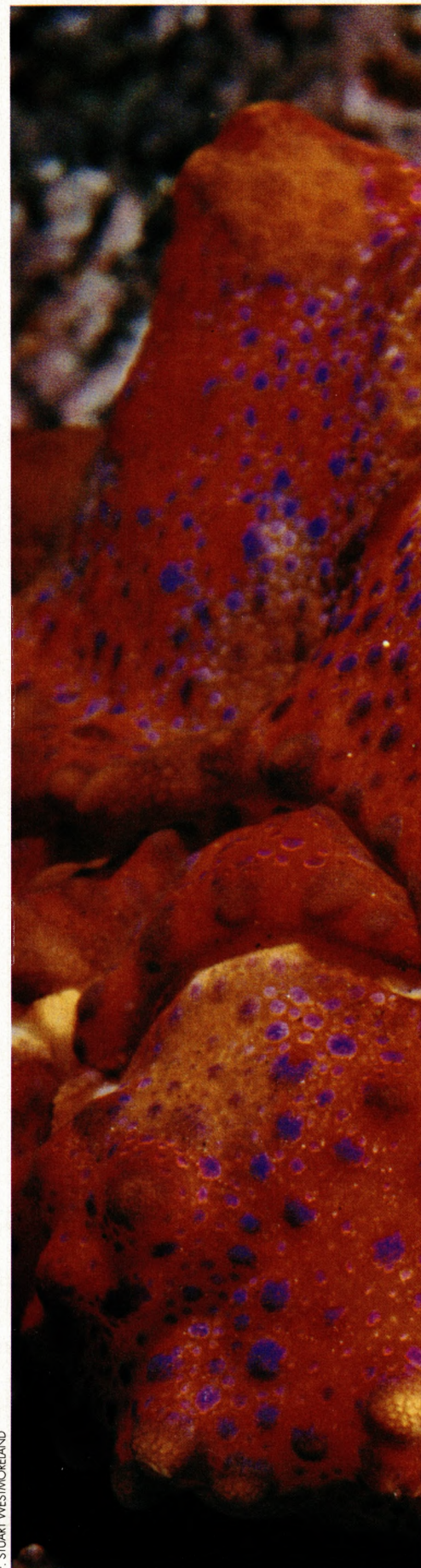
and hotel people — all the businesses that go hand-in-hand with tourism. But farther down, in the middle and lower Keys, where the relatively small Looe Key Sanctuary is located, there's a lot of opposition. There's suspicion about what's going to happen when the entire area is a sanctuary. A lot of people who make their living on the water don't know what to expect from a government agency that will control the source of their livelihood. Basically, they'll be living in a sanctuary."

Gloria Teague, manager of Atlantis Dive Center in Key Largo, thinks that most of the local dive industry is satisfied with the sanctuary plan for the Keys. "The divers pretty much want things protected, and the sanctuary people are trying to work with everyone's needs. Everybody down here goes to the meetings to make sure that their group doesn't get left out in the cold."

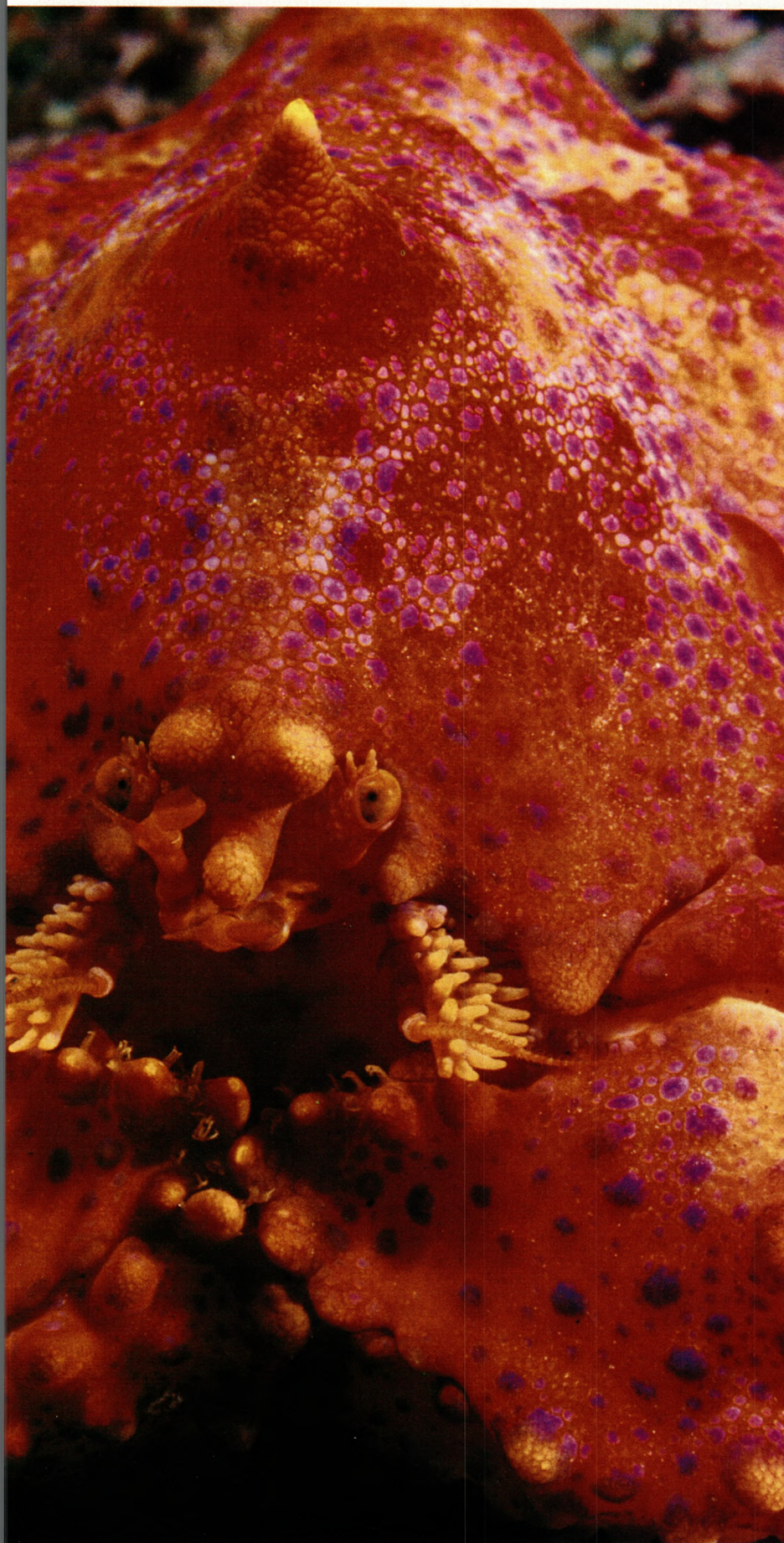
One change that divers in the Keys have experienced is a slightly altered lobster mini-season. In order to curb the sudden onslaught of lobster-crazed divers, managers have moved the season from the weekend to the middle of the week. This change, however, applies only to nearshore waters formerly regulated by the State of Florida. In the more offshore federal waters, the season still occurs on the weekend.

Another change being discussed for the Florida Keys is instituting user-zones, called sanctuary preservation areas. Some zones might be for diving only or just for fishing, while others might be temporarily closed to allow stressed reefs time to recover. As controversial as this idea seems, no decisions have been made yet. Management personnel are also working toward uniform fishing regulations for all parts of the sanctuary.

This king crab inhabits waters of the Puget Sound which are being considered for sanctuary status.



F. STUART WESTMORELAND



NATIONAL MARINE SANCTUARIES

Sand "grooves" are interspersed with coral "spurs" to create a rich habitat for all sorts of sea-dwelling creatures. Lobsters, crabs and fish play hide-and-seek among the hard and soft coral formations, sponges, and colorful sea fans.

Named for the *H.M.S. Looe* which sank in 1744, the sanctuary also encompasses seagrass meadows and sand flats. Snorkelers and divers alike will find much fascinating territory to explore at Looe Key.

Looe Key NMS
Route 1, Box 782
Big Pine Key, FL 33043
(305) 872-4039
George Schmahl, Manager

FLORIDA KEYS NMS

Surrounding the Florida Keys including both Key Largo and Looe Key sanctuaries, the Florida Keys National Marine Sanctuary was designated in 1990 and encompasses 2,600 square nautical miles in both the Atlantic Ocean and the Gulf of Mexico. Boundaries extend down from the outer boundary of Biscayne National Park just south of Miami, out to include the Dry Tortugas, and then come back around on the Gulf side of the Keys and up through Florida Bay where they abut with the Everglades National Park boundary.

In addition to offering protection to the world's third largest barrier reef system, the sanctuary is also home to a myriad assortment of marine habitats, ranging from backcountry mangrove islands which are a breeding area for many species of rare birds to the sea grass communities which are home to many juvenile fish and larval stages of mollusks and crustaceans.

In addition to snorkeling and scuba diving, activities include fishing, sightseeing and partaking of some of the world's finest seafood.

Florida Keys NMS
9499 Overseas Highway
Marathon, FL 33050
(305) 743-2437
Bill Causey, Manager

GRAY'S REEF NMS

Designated a marine sanctuary in 1981, Gray's Reef is a "live-bottom" reef located 18 nautical miles off the coast of Georgia at Sapelo Island. It is a submerged rock outcropping covering 17

NATIONAL MARINE SANCTUARIES

square miles that formed as glaciers advanced and receded across the North American continent during the Ice Age.

Surrounded by barren sand flats, the rock outcroppings, some up to six feet high, form a firm base for the live-



bottom reef habitat. Tropical fish migrate into the region during warm months and mix with more temperate species.

Ledges and overhangs of the reef provide refuge for all sorts of marine invertebrates as well as four species of turtles. North American Right Whales migrate into the sanctuary waters in early winter to give birth to their calves. Scuba diving trips are available to explore Gray's Reef.

Gray's Reef NMS

Univ. of Georgia Marine Extension Ctr.
P.O. Box 13687
Savannah, GA 31416
(912) 356-2447
Reed Bohne, Manager

MONITOR NMS

The *Monitor* sanctuary was designated in 1975 as our very first national marine sanctuary. A round column of vertical water one mile in diameter protects the wreckage of the Civil War ironclad that sunk less than a year after she was commissioned in 1862.

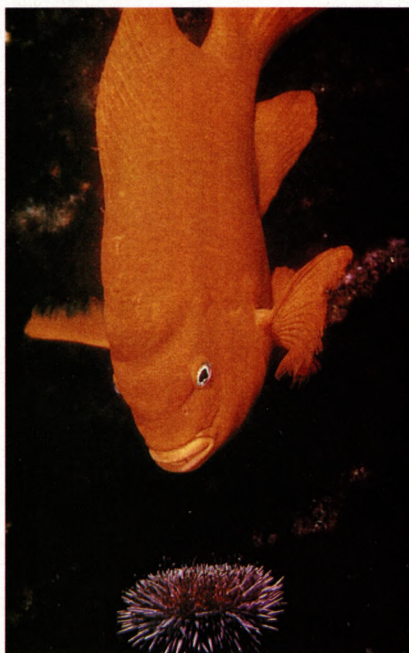
She now sits upside down on a sandy bottom in 230 feet of water, 16.1 miles off the coast of Cape Hat-

ENVIRONMENTAL THREATS

A serious problem facing management staffs is water pollution. Most of the nation's marine sanctuaries are situated along the coast and therefore affected by substances washed or dumped into nearshore waters. This means that sanctuaries are vulnerable to agricultural runoff and sewage dumping.

In the Keys as elsewhere, nutrients from sewage waste can cause blooms of algae and plants in nearshore waters. In extreme situations, this can lead to a decrease in the amount of light and oxygen in the water — and might threaten the coral reefs, which need clear, low-nutrient water in order to thrive.

One solution might be to eliminate the primitive cesspits and septic tank systems prevalent throughout the Keys. But the cost of such an undertaking would be enormous, and with so many other



A curious garibaldi checks out an urchin in the Channel Islands NMS.

potential threats to the reef, it's hard for researchers to agree on which is the most serious.

Another source of growing concern is the highly saline water of the relatively shallow Florida Bay on the Gulf side of the Keys. Decreased freshwater flow through the Everglades in recent years has

resulted in baywater that's much saltier than that on the ocean side. Researchers are concerned that this water, as it moves southeast over the reefs, may have detrimental effects on the coral. The results could be catastrophic.

CONFLICTS AND MISUSE

Confrontations between the sanctuaries and individuals or groups opposed to government restrictions are inevitable. Some have been highly publicized. When the Florida Keys sanctuary clashed with world-famous treasure hunter Mel Fisher, it seemed the whole world noticed. "What happened was a rather unfortunate turn of events," says sanctuary spokesman Robert Feingold. "We would have preferred to avoid conflict." But now the issue is before the courts.

Fisher's son Kane used prop wash deflectors to search for the remains of a sunken ship in a seagrass meadow just off Marathon in the middle Keys. "The meadow," says Feingold, "is a mixed seagrass community that has a little emergent reef." Fisher's methods resulted in strings of craters 30 feet in diameter and as much as 10 feet deep. But Fisher claims the holes resulting from the blasts are beneficial — that they are, in effect, new habitat.

NOAA disagrees and counters that Fisher has severely damaged the seabed, thereby breaking the law. The case has not yet been settled, but one thing seems certain — treasure hunters will probably always disagree to some extent with sanctuary managers on where and how to search for wrecks within sanctuary boundaries.

QUESTIONS OF ACCESS

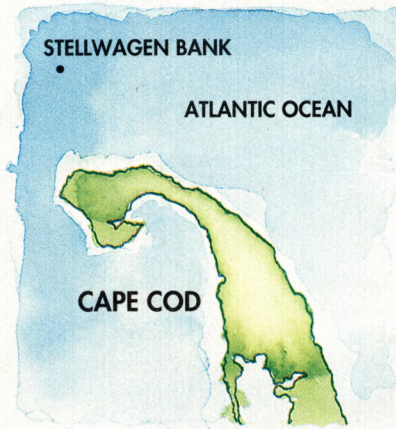
Another controversial wreck comprises the whole of the nation's first and tiniest, but perhaps most tantalizing marine sanctuary — the *U.S.S. Monitor*, which went down in a gale off the coast of North Carolina's Cape Hatteras in December

The playful sea lion is a common sight in California's marine sanctuaries.



NATIONAL MARINE SANCTUARIES

terras, North Carolina. Save an occasional visit by researchers, the *Monitor* is off limits to everybody else. The general public cannot drift, stop, anchor, fish, dive, or trawl over the site. Artifacts brought up from the *Monitor* are



on display at the Mariner's Museum in Newport News, Virginia. Some "public access" for scuba diving is under consideration at this time.

Monitor NMS, NOAA
Building 1519
Fort Eustis, VA 23604-5544
(804) 878-2973
Dr. John Broadwater, Manager

STELLWAGEN BANK NMS

Another 1993 designation, Stellwagen is located six miles off the northern end of Cape Cod, Massachusetts in the southwestern Gulf of Maine. The main attraction here is the proliferation of breeding whales that frequent the area. Humpbacks, fin and northern right whales, orcas, pilot and minke whales as well as several species of dolphins use the fertile Bank area as a nursery and feeding grounds for their young. Whale watching brings in a million visitors a year to Stellwagen.

Stellwagen Bank NMS
14 Union Street
Plymouth, MA 02360
(616) 982-8942
Brad Barr, Manager

FUTURE SITES

Proposed and study sites for possible future marine sanctuary designation include: Kahoolawe Island (Hawaii), Norfolk Canyon (Virginia), Thunder Bay (Great Lakes), Northwest Straits (North Puget Sound) and the Olympic Coast in Washington state.

1862. Lying lost on the ocean floor in 230 feet of water for over 100 years, the *Monitor* was finally located by a team of scientists in 1973. Initially considered almost undivable because of its depth, the ship has been visited by just a handful of researchers, most in submersibles.

With the advent of new, more sophisticated diving technology, and research that utilizes sport diving techniques, NOAA is seriously contemplating granting limited public access to the *Monitor*. Special-use permits would be required, and there are a number of difficulties to overcome. First, there's no anchoring allowed directly on the wreck itself. And presently there's no buoy system at the site.

"It can take three days just to properly set an anchor," says Cheryl Graham, program specialist with NOAA. "And even then you can only fix a buoy or something small like an inflatable to the line, because a strong current working against a large boat could drag the anchor into the wreck. Meanwhile, the dive boat has to wait nearby."

Then there's the current to consider — it's almost always running. If you do manage to get an anchor in and prepare for a dive, your bottom time is limited. There are usually decompression stops to make.

For those who do make it, it's



In addition to whales, the Hawaiian sanctuary waters offer other amazing sights.

an exquisite dive. John Broadwater, manager of the *U.S.S. Monitor* Sanctuary, describes it as incredible. "It's really a once-in-a-lifetime experience. Quite often the Gulf Stream will come in, and the diving conditions are just super, 100 feet of visibility or better. The light penetration is so good that you can see quite well and can make out all the vessel's details. Water temperature ranges from the high 60s to the high 70s, and when the Gulf Stream has been coming in for several days you can see all kinds of tropical fish, including angelfish — anything that you might see in the Florida Keys. The wreck has beautiful soft corals and every colorful fish imaginable. The *Monitor* is essentially an artificial reef."

PROTECTING THE COASTS

In late September 1992, the nation's newest marine sanctuary, Monterey Bay, was dedicated amid much celebration up and down the California coast. "There's a lot of excitement out here," says NOAA's Bill Schramm. "You might find a few people who are unhappy — perhaps the oil industry." Oil and gas exploration will be prohibited in the sanctuary.

"It's been 15 years in the coming and people want to see the coastline protected. Most people recognized that this is the smart thing to do, economically and otherwise." Citing overwhelming community support so far, Schramm foresees an army of folks volunteering to assist the visitor centers.

And perhaps that's what the sanctuary program boils down to — fostering an individual's sense of responsibility. "That's the big thing we've learned from our land-based natural parks," says NOAA's Ralph Lopez. "Each individual does have some responsibility to ensure that the area he's using is protected." ■

Native Floridian Pat Canova enjoys capturing in pictures and words exciting underwater images including those found throughout the National Marine Sanctuaries.

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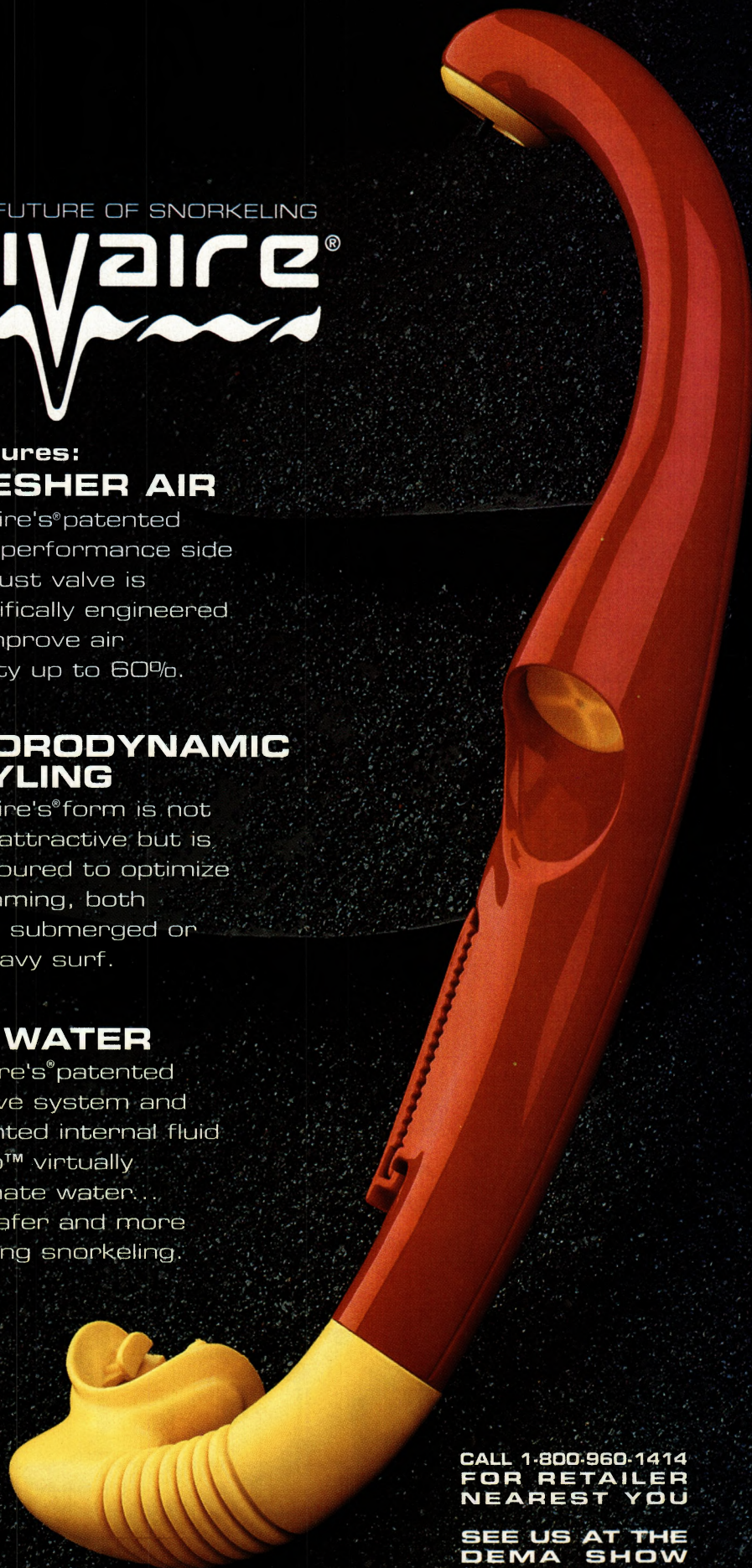
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The sailors of long ago knew their charm. We were about to rediscover it.

Many speculate that the mermaids so prevalent in maritime lore were actually manatees — large, gentle marine mammals. While our interest was probably much less hormonal than our sailing counterparts of years past, the desire was just as strong.

We'd all come to Crystal River, Florida in hopes of coming face-to-face with an animal that might soon disappear from the planet, becoming no more than a memory.

Or another myth.

In light of the manatee's endangered status, some concerned citizens and environmental groups believe that people should stay out of and off of the water when the sea cow comes to town. They'd rather see encounter programs extinct before **by Vince Rhodes** the same fate befalls the manatee.

But for better or for worse, we gathered that Saturday morning to answer the siren's call — or more precisely, the Sirenian's call.

meet the manatee





DOUG FERRINE

THE MANATEE FAMILY TREE

The West Indian manatee (*Trichechus manatus*) belongs to the order Sirenia and evolved from four-footed land mammals which entered the water over 60 million years ago. The presence of undeveloped pelvic bones are mute testimony to the manatee's terrestrial beginnings.

The West Indian manatee is one of the four surviving species in its order. Steller's sea cow (*Hydrodamalis gigas*), a fifth species, grew to almost 35 feet in length and weighed several tons. The only cold-water sirenian, it fed exclusively on marine algae. Discovered by Steller, a ship's doctor, in the Bering Sea in 1741, it was hunted to extinction in only 27 years.

Consisting of one species of dugong and three species of manatees, the living sirenians are tropical and sub-tropical in distribution. In the past, the dugong (*Dugong dugon*) could be found in many areas. Now, it's limited to coastal regions of the Indian and Pacific oceans with the largest populations found in the waters of northern Australia.

Manatees can be found along both the eastern and western tropical coasts of the Atlantic. Information is scarce on the West African manatee (*Trichechus senegalensis*) which makes its home in the coastal waters and rivers of western Africa. What is known, however, is that the population has been greatly reduced by hunting and netting.

The Amazonian manatee (*Trichechus inunguis*) isn't doing much better despite legal protection. Found in the fresh waters of the Amazon basin, populations are still threatened by illegal hunting. And ineffective enforcement fails to turn the tide of decimation begun centuries ago.

Cool winters, deep water and strong currents have combined to segregate the remaining population of West Indian manatees. Although this species can be found from the southern U.S. to the northeast coast of Brazil, recent studies of skull characteristics have shown evidence of

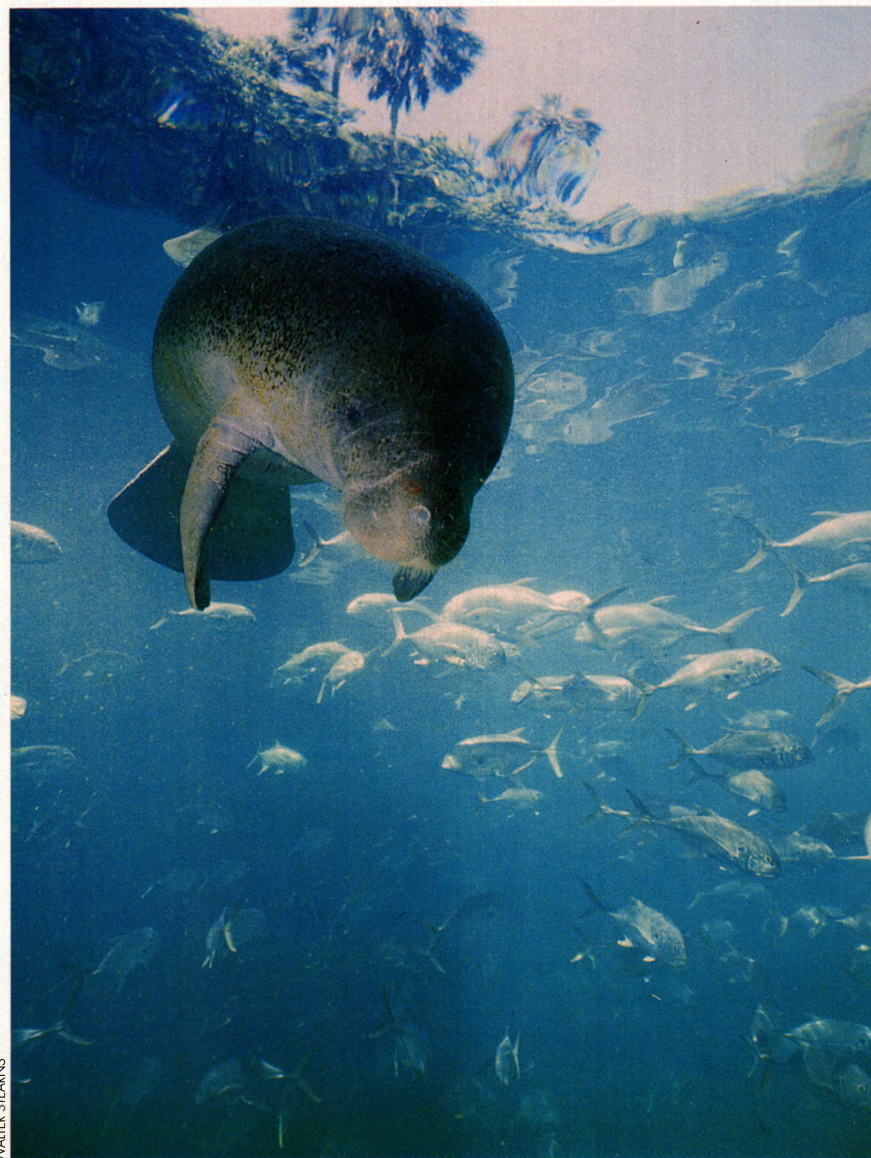
genetic isolation. The manatees found in the southern United States, or Florida manatees, are a distinguishable sub species (*Trichechus manatus latirostris*).

MARINE MAMMALS 101

Before our encounter comes education. Bill Cirimo of Sea Ventures Marine Education Institute has been teaching this education pro-

waters. Approximately 300 winter in the Crystal River National Wildlife Refuge (CRNWR). That may be as much as 50 percent of the Florida west coast population.

Exceptionally large manatees have reached lengths of 13 feet and weights of 3,500 pounds but the average manatee is actually closer to nine feet in length and weighs about 1,200 pounds. Generally, females are



Manatees are attracted to the warm spring waters found throughout Florida.

gram for five years. He conducts classes at Bay Point Dive Center from November to March — the season when manatees seek out the warmer waters of Crystal River.

The most recent population survey indicates there are a minimum of 1,856 manatees in Florida's

larger than males.

Depending on the age of the animal, manatees have three or four nails on their front flippers. These forelimbs are used both in navigation and to move food into the mouth. The manatee also uses its flexible upper lip to manipulate its meals.

The sea cow is uniquely adapted to its herbivorous diet — it constantly replaces teeth. As grinding molars wear out, they move forward in the mouth and eventually fall out.

Manatees eat the equivalent of about 10 percent of their body weight each day. Their digestive system is similar to that of other plant-eating animals such as horses or cows, with bacterial digestion occurring primarily in the hind part of the gut. In adults, the intestines can measure up to 130 feet in length.

In general, the manatee will eat and sleep throughout the day and night. During winter cold spells, however, activities such as feeding may be regulated by a diurnal temperature cycle. During these periods, manatees tend to search for food in the afternoon and evening when the water outside the springs is warmest.

Behind all the facts, figures and trivia we're absorbing, there's more than just a hint of environmental concern. "We want to get you thinking about conserving the manatees," Cirimo explains. "Man is directly related to the extinction of species."

That's about to become abundantly clear.

The next slide to illuminate the screen evokes an audible gasp. It shows a manatee with a series of slashes up its back. A boat has run over the animal lengthwise from tail to nose slicing completely through the skin in several diagonal cuts. It's not a pretty picture.

Soon an aerial shot of a large boat speeding through the water flashes onto the screen. Cirimo smiles. "This is our friendly speed-boater," he explains. Another image of the boat appears. "This is our friendly speed-boater as he flies through a manatee no-wake zone."

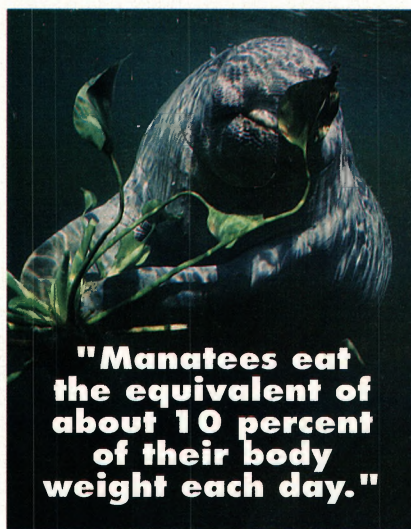
He points to the left of the screen, just out of the range of the slide. "This is where he was stopped by the Coast Guard and given a \$5,000 fine for speeding." Cirimo chuckles.

"Had he hit the manatee or, worse, killed it, he could have been fined \$10,000 and his boat seized." Cirimo's smile dies. "But

that still wouldn't bring back the manatee."

Manatee mortality is a definite concern because of the animal's slow reproductive rate. Most females begin to breed successfully by seven to nine years of age while males become sexually mature at age nine. The female attracts male counterparts with very low infra-sounds and scents in the water.

Fertilization takes approximately 20 hours and the female will mate with 12 to 15 males. The gestation period for manatees is about 13 months, producing generally one calf per pregnancy. Twin births have been reported, but are extremely rare. Newborn calves are generally about four feet in length and weigh about 66 pounds.



Calving occurs year round with an interval between births of three to five years, but researchers aren't sure if these births are enough to offset the deaths that occur. Additionally, data from the Florida Marine Research Institute indicates that infant mortality rates may be on the rise.

Cirimo doesn't want his divers to add to the problem. So, our education course concludes with some rules of engagement. "First," says Cirimo, "respect the animal's choice for an encounter. Let them come to you. Don't chase them — that's harassment. Second, be motionless when you're touching them. Don't try to pet them as you swim. There's a simple guideline — if your fins are moving while you're petting,

you're chasing.

"And third, if you find a manatee at the bottom, don't dive bomb. It may be sleeping or eating and you can break it's natural cycle. Just be patient. Remember they come up to breath about every two minutes. Is everyone ready?"

"Then, let's go."

CLOSE ENCOUNTERS

Getting ready for our rendezvous, we grab snorkeling gear and wetsuits — 72 degree F spring water may be balmy for manatees, but it's a tad chilly for people. Equipment in hand, we board the pontoon boat and head out into Crystal River.

We go only a short distance away from the dock when Cirimo stops the boat to look for the tell-tale signs of sirenians. We scan the water for "footprints" (swirls created at the surface by the tail as the manatee swims) or gray noses poking out above the water's surface. In under a minute we sight one pair and then another and then another.

Shrugging on farmer johns and wetsuit jackets and quickly defogging masks, we slide as silently as possible into the water. The crew and divers still on the boat offer directions as they see more and more manatees from their elevated vantage point. "Remember not to splash when you kick," Cirimo calls out as we swim slowly away.

I hear it before I see it. Moving away from the other divers, I hear a quick snort. It has to be the sound of a manatee rapidly exchanging the air in its lungs. Turning slowly, I just glimpse the tip of a nose as it descends back into the river. I head slowly for the spot.

Ducking my ears under water, I hear an amazing sound — crunching. I can actually hear the manatee eating! Even though I can't tell which direction the sound comes from, I know I'm close. Suddenly, a face materializes in the murky water before me and I jump slightly. It just appeared out of nowhere. I was the one who'd been encountered.

Hearing that something is ten-feet long still doesn't prepare you for

seeing something that big. The manatee was huge. Looking at me for just a few moments, it soon turns its attention to the vegetation on the river bottom. Still watching the magnificent creature below me, I notice the traces of algae, the striations on its back and the inevitable nicks in its tail from previous boat encounters.

My heart begins to race as another manatee moves into view. After a moment, both swim away with their tails flapping gracefully as they disappear into the murk. With a foolish grin I lift my head from the water and float giving my overloaded senses the time to process every aspect of the meeting.

Another diver swims up to me and points just over my shoulder. She had spotted another one. We paddle quietly over to the spot where a sea cow busily munches. It pays no attention to us. We drift along with the current watching as it crunches continuously — its flippers and proboscis guiding more and more vegetation into its waiting mouth. After a few minutes, we leave the mammalian vacuum cleaner to its meal and go in search of others.

Swimming back toward the boat, I hear a high-pitched vocalization followed by a lower response. Slowing my pace, I'm soon rewarded with the sight of a mother and baby. As I watch in awe, the baby nuzzles behind the mother's flipper, probably nursing. When the baby finally catches sight of me, it swims under its mother to her far side. With a sigh, I leave the two to their lunch and seek the warmth of the boat.

Back on board, the few other divers taking a break are a sight to behold. Gesticulating emphatically, some describe their adventures in excited tones. Others sit and speak with hushed voices about this or that animal. There can be no doubt everyone has been profoundly affected by the encounter.

Feeling an irresistible urge to share my experiences, I begin to tell Cirno about the mother and baby I had seen. He smiles as he listens and then shares a few of his own encoun-

Manatee Rehab Program

Now you can come face-to-face with a manatee without even getting wet at Sea World of Florida's new exhibit "Manatees: The Last Generation?". One wall of the 300,000-gallon habitat is a 126-foot-long acrylic panel that allows you to glimpse these marine mammals in their underwater environment.

None of the manatees were captured for display purposes — they're all patients. In fact, opened in 1993, the exhibit is just an extension of Sea World's well-established manatee rescue and rehabilitation programs. "The whole reason for this exhibit is rehabilitation," explains Toni Caracciolo, public relations associate for Sea World of Florida. "It was getting to the point that we needed more space for the manatees we were trying to help. So, we decided to make it an educational experience."

The park works with federal, state and local agencies to help these marine mammals. A typical recovery starts with a call from a private citizen to the Florida Marine Patrol Manatee Hotline — (800) DIAL-FMP. After the report, either the FMP or Florida Department of Environmental Protection is dispatched to confirm the animal's status.

According to Dr. Mike Walsh, a staff veterinarian for Sea World of Florida,

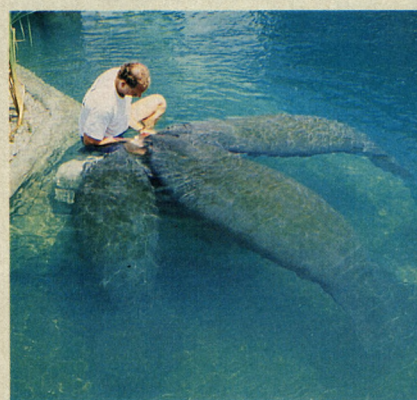


PHOTO COURTESY OF SEA WORLD

All the manatees at Sea World of Florida are patients in the rehabilitation program.

well-meaning observers have occasionally called for help when it wasn't necessary. Rescue teams would head to the scene only to find a manatee was simply asleep or mating. This prompted the intermediate verification.

After the DEP or FMP has determined a manatee is actually in need of

assistance and not exhibiting some natural behavior, the Sea World rescue team heads out. Apprehending the manatee takes from four to eight people and that number doesn't include the team members that remain at Sea World to prepare receiving tanks and medical assistance.

Manatees brought in for medical treatment and rehabilitation fall into three categories: victims of watercraft trauma, orphans or those experiencing natural diseases. Walsh says Sea World is seeing more blunt trauma induced by boat collisions.

The scratches on the back and nicks out of the tail may be graphic reminders of boat encounters, but unseen injuries can be just as debilitating. The impact can break ribs, cause head injuries and even rupture internal organs. In these cases, the manatee can survive weeks or months before it finally dies from the injury.

The number of orphans rescued varies from year to year and no one knows why. It may be that, as in many species, first-time mothers don't always do the best job. They may be completely disinterested. "In many cases, the baby manatees never nurse and are never cared for," says Walsh. "They may be so hungry that they eat anything — even things they can't digest."

When an orphan is rescued, it receives round the clock attention. While 24 hour care, a warm environment and nutritional support help their recovery, these young invalids need something more. They have to learn how to be manatees.

"The big question," says Walsh, "is whether we can release these orphans. This new facility is a nice step down. They have fish and turtles in the tank with them. We also start putting food on the bottom so they get used to that."

Rita, an adult manatee that lives in the exhibit, also assists the orphans. "These baby manatees have been near humans around the clock," says Walsh. "We have to look to the future when they will be released. We want them to be as manatee-ish as possible. Rita helps socialize the babies."

In addition to demonstrating proper marine mammal manners and eating

by Vince Rhodes

habits, Rita's fecal material contributes vital bacteria to the habitat. Because they were rescued at an early age, many of these young manatees may lack the microorganisms they need.

But living in the wild is no guarantee that the manatee won't have problems. Cold snaps can cause young manatees with thin blubber layers to catch viral infections. And Walsh adds that some of the manatees they rescue require flipper amputation due to entanglement in monofilament fishing lines or crab pots.

Fortunately, there have been many advances in manatee medicine. More research centers and people have become involved. "We've radiographed manatees," says Walsh. "We've performed ultrasounds and administered the first anesthesia ever given to a manatee. For the most part, we've been very successful."

had broken some ribs and trapped air in the animal's lung cavity. As a result, Fathom had stopped eating and become very skinny.

But some creative thinking and the cooperation of a local company made the difference. Manatees have lungs which are completely separated from each other, helping the animal to regulate its buoyancy.

To compensate for the unnatural shift caused by the boat collision, the manatee was fitted with a wetsuit and it began to eat again almost immediately. Fathom was named for the manufacturer that provided this highly specialized wetsuit.

But the efforts of Sea World alone aren't enough. "All we're doing won't mean anything unless people get involved," says Walsh. "A lot of effort is being put in to help this species before it's too late. That's encouraging. It's hard

ters. In the middle of one of his stories, however, he stops abruptly and stares over my shoulder.

"Hey," he yells. "Hey, slow down! This is a no-wake zone!"

Turning, I see why he's yelling. A small aluminum boat zips through the river churning up wake as it goes. Decked in colorful wetsuits, they're obviously headed for Kings Spring and some sort of diving or snorkeling.

Cirno continues to shout. "Slow down! If you're making a wake you're going too fast!" Finally getting the hint, the driver slows the boat to an idle speed and continues on course.

Disgustedly Cirno turns back to me. "People fly though here in search of manatees and then BUMP. Suddenly they're asking 'What was that?' People go right to Kings Spring thinking the manatees will all be waiting there like some petting zoo. They don't realize they're everywhere.

"There are other groups that rent boats and just send people out, but that's not what we do. That guy had no clue. He probably rented the boat and was told to go at idle speed, but he has no idea what that means."

ENCOUNTER OPPOSITION

It's situations like this which have some environmental groups and private citizens worried. The Florida-based Save The Manatee Club was formed in 1981 by singer Jimmy Buffet and then-Governor Bob Graham to help this endangered species survive.

Judith Vallee, executive director of the Club is especially concerned. "Crystal River National Wildlife Refuge is the largest natural winter refuge for the manatees," she explains. "If one person does an activity, that's fine. But Crystal River gets 100,000 visitors a year — 70,000 of them are divers.

"That puts tremendous pressure on the refuge. It's my feeling — and some residents mention it, too — that some activities such as open water certifications could be done elsewhere. When you have a large



Rescued orphan manatees receive round-the-clock attention. Initially tube fed, babies graduate to bottle feeding and are then weaned over a one- to two-year period.

Over the years, Sea World has rescued 123 manatees. Of those, 35 have been released and the potential exists to release another 14. And Walsh says three or four of those releases may occur in the next year. Overall, Sea World boasts a 35 to 40 percent success rate in helping manatees recover. That's good for any animal rehabilitation program. "If you have an 80 to 90 percent success rate, you're not dealing with the tough problems," explains Walsh.

You only need to hear the story of Fathom to know that Sea World doesn't avoid the "tough" problems. When this manatee was found, it was floating, unable to dive. An encounter with a boat

for people to understand and it's hard for the DEP to go against public opinion. There are always people who don't believe there is a problem."

Walsh hopes that the Sea World exhibit and rehabilitation program will help change public opinion. "Everyone's been wanting an exhibit," he says. "It wasn't added to get more people in. It was to built to show the ones already in the park what's going on.

"We have to influence the public here the same way we did with cetaceans. Millions of people have to see the manatees. To get them to give up boating or slow down in certain areas, we have to let them see the animals."



JESSE CANCELIANO

The closest modern relatives of the manatee are the elephants and small African and Asian mammals called hyraxes.

number of people in the same area with an endangered species, there's an increase in harassment.

"Many times you see a manatee swimming away and you see a diver following it. That can result in separation of a mother and calf. Also, people try to hug them." With a pained look she adds, "There have even been manatees found with initials carved into their backs."

Another of the group's worries is the loss of habitat caused by divers. As the diving population increased, many people believed the manatees would be driven out of the area. Actually, Vallee says that many times the exact opposite occurs. A large number of divers may frighten the manatees enough to keep them in their sanctuary zones, preventing them from leaving to feed. Not the problem people expected, but a problem nonetheless.

For these reasons, the Club advocates passive observation to minimize human impact. "I think most people would give [encounter programs] up if they knew their fun could be life threatening for the

manatee," says Vallee. "I'd like to get in the water and see one close-up, but I'm willing to give that up."

MANATEES IN COURT

The 33,000 members of the Save The Manatee Club aren't the only ones concerned. In October, the Audobon Society and others filed a lawsuit against the U.S. Fish and Wildlife Service claiming that they were allowing incompatible use of resources on wildlife refuges.

"The lawsuit was fairly broad," explains Pat Rose, administrator for the Office of Protected Species. "It said that Fish and Wildlife wasn't carrying out its charge to protect resources. In the case of Crystal River, the solution was to provide more protected areas."

According to Cirimo, the sanctuary areas for manatees are now twice as big as in previous years. But Vallee still isn't sure its enough. "A couple of places that were set aside have no warm-water source. They're set aside for certain things such as feeding or warmth. We need to assess whether this will meet those

needs. Besides," she adds, "I've seen people go under the buoys."

All parties involved agree that enforcement is a major difficulty. There just aren't enough resources to effectively keep track of everyone and everything. "Enforcement is a tremendous problem," Vallee says. "It's hard to regulate with all those people there. You just can't get everyone who needs to be gotten."

One thing that has changed is Coast Guard participation. Cirimo says that more of the "passenger-for-hire" laws are being enforced. People that rent boats to take groups out and encounter the manatees are being held increasingly responsible for their actions. According to Cirimo, fines can range up to \$20,000.

The Audobon lawsuit has since been settled out of court. One of the conditions was that the CRNWR implement a public use management plan. As a result of this plan, several restrictions have been imposed.

A "swim only" access corridor was created. Divers and swimmers may only approach Kings Spring through this corridor. The remainder

of the area has been added to the Banana Island manatee sanctuary where all waterborne activity is prohibited between November 15 and March 31.

Night diving in the spring area has also been curtailed during the same time frame. From 7 p.m. to 7 a.m., use of all refuge waters, including the swim corridor and adjacent spring, is prohibited.

Rose says this looks like a lot of restrictions if viewed narrowly, but it's not the end of encounters. "Divers can still find manatees in dozens of places around Crystal River if they are patient and quiet. The water might not be as clear, but there will still be opportunities."

MEETING IN THE MIDDLE

Everyone concedes that the main cause of manatee mortality is boat-related. According to Dr. Dan Odell, research biologist at Sea World, probably half of all manatee deaths are human-related and a majority of that 50 percent is due to boating collisions.

Another result of the CRNWR management plan is that boating is restricted completely in the Banana Island waters from November 15 to March 31. But as Crystal River gains popularity, more divers will come and more boats will enter the water to carry them.

Manatee Information Sources

Bay Point Dive Center
300 N.W. Highway 19
Crystal River, FL 34428
(904) 563-1040

Sea Ventures
Marine Education Institute
P.O. Box 23931
Jacksonville, FL 32241
(904) 268-0956

Save The Manatee Club
500 N. Maitland Avenue
Maitland, FL 32751
(407) 539-0990

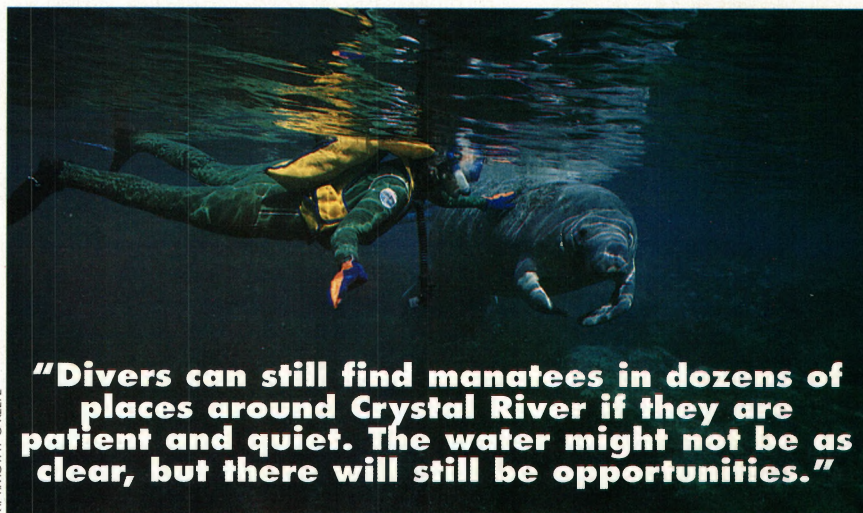
To emphasize the gravity of the situation, Vallee quotes a Florida Marine patrol statistic predicting that by the year 2000 there will be two million boats in Florida waterways. "How can the manatees hope to survive," she asks. But, just because boats are the main culprit, Vallee doesn't think that diving should be unrestricted.

"No one can say that John Smith going diving forced a manatee out of an area and caused it to die," she explains. "I think any interaction is

they need to do."

Cirno thinks his education program can be a part of the solution instead of part of the problem. "There's always going to be interaction between manatees and humans," he says. "There's nothing you can do to stop that. Up until the past few years, that impact has all been negative.

"If there is some negative impact to our program, it's far outweighed by the positive influence of so many people becoming concerned. I don't



"Divers can still find manatees in dozens of places around Crystal River if they are patient and quiet. The water might not be as clear, but there will still be opportunities."

causing problems. In the grand scheme of things, boats are still far and away the main problem. But, underlying the whole problem is loss of habitat and you have to include diving in that."

None of the parties involved pretend to have all the answers. In fact, everyone seems to want to save the endangered manatee. There is just disagreement on how far regulation should go. The Save The Manatee Club believes that some state and federal agencies and officials aren't willing to make unpopular decisions.

"Because the National Wildlife Refuge was established specifically for the protection of the manatee, that should be the priority," argues Vallee. "Anything else should be dealt with in a less prioritized way. If protecting the manatee means shutting the spring down, that's what they should do. If it's getting divers out of the water when it drops to a certain temperature, then that's what

feel we have a negative impact, though. People come here from all over the country and leave wanting to help the manatee."

Rose also isn't sure that stopping diver interaction with the manatees at Crystal River is the solution. "We encourage people to go to Crystal River National Wildlife Refuge," he says. "Divers can do more harm at other places where the manatees are at greater risk. In other areas, the manatees aren't used to divers and they can panic. In these other places, there are often severe water temperature differentials and more boating traffic."

It all comes down to responsibility and respect for the manatees. "Can divers adversely affect manatee behavior," Rose asks. "Yes. There are cases of disregard. These people mess it up for the responsible divers. Divers are the best friends the manatees can have, but it's important for the manatees to have a safe environment."



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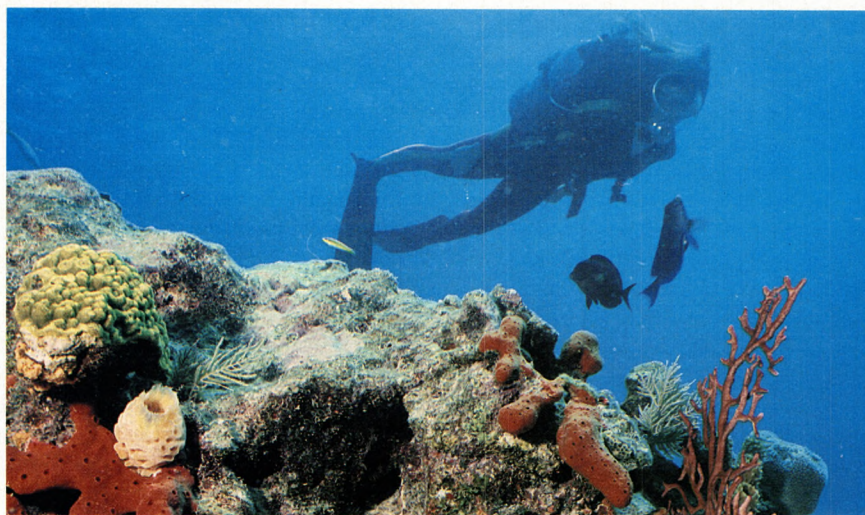
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Product Information 2



DOUG PERKINS

Gearing Down

If there were twelve-step programs for scuba diving, I would be a charter member. I'd have to stand up at each monthly meeting and say: "My name is Pierce, and I'm a gearaholic."

A lot of people have a closet full of dive gear, but I actually have a double-garage worth. While many of the more unusual items can be attributed to my specialty pursuits such as overhead environment and mixed gas diving, there's also plenty of everyday dive gear, because I can't seem to pass a dive shop without pulling out the wallet.

But while I can't say no to buying each and every new gadget and toy, I have at least learned not to attempt to wear the entire collection each time I go diving. This may sound obvious, but I've seen more than one diver who hasn't learned this lesson yet.

Last year in the Keys, for example, a boat load of divers were getting ready for a drop on an artificial reef ship sunk in 110 feet of water. It was a non-penetration dive in warm, gin-clear water, and everyone was wearing skin suits, tropical BCs and aluminum 80s.

Except for the two guys from the northeast who proudly donned their dry-suits and cumbersome double tanks. It

was a "wreck dive" and they were ready...they were also pretty uncomfortable in the balmy 90 degree sunshine.

On the *San Francisco* or some other technical wreck, I would have been dressed as they were. But come on, this was Florida in the summer and our boat captain expected us to abide by boat rules and stay out of decompression and refrain from penetration.

Point is, there's a time and place for each piece of gear, and just because you own it doesn't mean you have to wear it. By all means carry those items that contribute to your comfort, safety or enjoyment, but don't fall into the trap of gear for gear's sake.

Review your planned underwater activities before each dive trip and select your gear accordingly. When done properly, this not only contributes to your diving pleasure, but can actually add rather than subtract to your "gearaholic" tendencies.

Now, rather than simply grabbing a large pile of goodies and stuffing them into a bag, you can meticulously sort, catalog and re-sort each item and will arrive at the site looking like an experienced, high-end diver rather than a walking hardware store.— *Pierce Hoover*

Dive Locker

This issue's equipment section leads off with a test dive of a new underwater communications system, the DIVE LINK. Unlike previous comm systems which were bulky and expensive, the DIVE LINK proved to be diver-friendly and retails for about the price of a top-shelf regulator. Look for them to start cropping up on dive boats soon.

Also in this issue, we test dive Poseidon's Odin regulator, which is now distributed in the U.S. by Parkway. You won't outbreath the Odin. Even if you go deep and work hard, its simple yet rugged design will ensure years of low-maintenance service.

We also got our hands on a new Nemesis computer that offers air-integrated software without the high pressure hose. The Nemesis lets divers get rid of the dangling console, and tracks not only decompression information, but also such items as tank pressure and breathing rates.

In our *Head To Head* comparison, we examine the pros and cons of buying a custom wetsuit rather than taking one off the rack or buying mail order. And if you want to stay even warmer in your new suit, check out the battery-powered wetsuit heater in the *Innovations* section.

Corrections

In the *Head To Head* column in our Preview issue, the buoyancy characteristics of two of the three tanks listed were misprinted. The OMS 121 is actually 9.5 pounds negative when full and neutral when empty, while the Beuchat 120 is 24.4 pounds negative when full and 17 pounds negative when empty. Sorry for any confusion these typos may have caused.

Equipment

TEST DIVE

*Underwater communications,
rugged regulators and hoseless dive computers*

DIVELINK

The forecast called for 15-knot winds and five-foot seas off Palm Beach, which was a concern for my sometimes weak-stomached dive buddy. "It's a good day to beat up some test gear," I reassured him as we lugged our bags aboard the charter boat. *[Point of Information: I didn't get sick - M.Ed.]*

Factory rep Troy Palmer was already on board with a bag of DIVELINK underwater communication devices. Each unit consisted of two parts, a beanie-like headpiece that took the place of a mask strap, and a oversized mouthpiece that replaced the standard model.

Setup was merely a matter of running my mask through the transceiver unit's straps and securing the mouthpiece to my second stage. By the time the boat had shouldered through the inlet breakers, I had the microphone cord secured to the regulator hose and was ready to transmit.

Or so I hoped. The DIVELINK had the look and feel of an especially sturdy piece of gear, but thanks to the rough cross seas, I had managed to drop it on

the deck and bang it against the tank rack several times while assembling it.

At first glance, I had my doubts about the mouthpiece. Because it was larger than a standard model, it looked like it might be heavy or awkward. In addition, the usual bite tabs were replaced by thinner plastic tabs that hinged inside the mouthpiece and protruded a mere quarter inch from the rubber surface.

It fit, so I decided to reserve judgement until after the dive. Securing the transceiver on my head took scarcely longer than adjusting a conventional mask strap. The bone transmission microphone was positioned just forward of my ear, and with everything in place, I took the plunge.

The DIVELINK is a voice activated system, and Troy had mentioned the need to preface any transmission with an umm or "warmup" word to activate the mike. Talking was easier than expected, and the mouthpiece's tabs allowed full jaw movement without undue pressure.

Troy had told us that the learning curve on the DIVELINK varied. NOAA

science divers had tried the unit the week before and were conversant within a couple of minutes, he said, while the average diver should get used to the unit by the end of the first or second dive.

Actually, it only took us a couple of minutes. Pilots or anyone with a radio background will have a head start on the DIVELINK, because communications run much smoother when radio protocols are used. A typical conversation might sound like this:

"Umm Vince, what's your air pressure..... and deco status, over."

"Ahh Pierce, roger that elevenhundrandanimocay, over."

"Umm, Vince, say again."

"Ahh Pierce, 1100 and I am OK."

Notice the pause in my long transmission. That's there to give us both a chance to breath. We quickly learned to talk between breaths, and also to listen between breaths. Once we were aware of each other's listening and talk cycles, it didn't take long to establish a rhythm.

As divers gain familiarity with the DIVELINK system, underwater communication becomes a relatively simple matter. What the DIVELINK is not is an underwater telephone. It's not designed for two or three divers to spend the entire dive chatting non-stop about next week's big game or tonight's dinner plans.

After the initial novelty of talking underwater passed, we soon found ourselves confining our transmissions to the more important information that would otherwise be confined to hand signals or slates.

The DIVELINK transmits an ultra sonic signal, much like a dolphin or depth sounder would. In theory, that limits communications to line of sight, but we found we were able to communicate on opposite sides of an artificial reef. This is possible because the sonic signal bounces off the ocean surface and echoes to the other diver.

Unlike expensive commercial units, the DIVELINK offers affordable, reliable and easy-to-use underwater communications technology that will work with standard dive gear.



TEST DIVE

After an hour in the water, my initial misgivings about the mouthpiece were completely forgotten. I experienced no jaw fatigue, and except for the occasional voice of my dive buddy, I had almost forgotten I was wearing the "extra" components.

The only question that remained to be answered after those first dives was a philosophical one. Many of us enter the "silent world" to escape the outside world. Would the DIVELINK intrude on this tranquility?

After making a number of additional dives with the unit, I have found otherwise. It's easy to share vital information and alert a dive buddy to a special underwater wonder, but these conversations always seem welcome rather than intrusive. In fact, after diving with a DIVELINK for a while, one begins to feel a bit lonely without it.

MORE FACTS ABOUT THE DIVELINK

The underwater units we were wearing were COM-UO1 models. They had an estimated average range of 150 feet, with greater distances possible in

certain conditions. They will allow for about four hours of operation based on the diver transmitting about 20 percent of the time. A large "on-off" lever on top of the headpiece also has an emergency beacon position that transmits a low-frequency locator signal.

The COM-UO1 is powered by a pair of matched-cell nicad batteries which can be recharged without needing to be "drawn" down the way many car phones and some underwater lights must be.

The mouthpiece and face mask strap are made of a high quality silicon rubber manufactured in Finland, while the electronics are made in the U.S. and assembled at the company's headquarters in Canada.

In addition to the diver-to-diver units, DIVELINK offers a surface unit that allows two-way communications with divers, along with listen-only units for use by students and dive tours.

Several research organizations have already expressed interest in the DIVELINK, and most dive instructors and divemasters quickly see the benefits of the unit.

With the DIVELINK's relatively low

retail price, durability and simplicity of operation that allows divers to use their own mask and regulator, it shouldn't be long before these units also start showing up on dive boats.

For more information, call (503) 463-8775 or write DIVELINK at 4935 Indian School Road NE, Salem, OR 97305. — *Pierce Hoover*

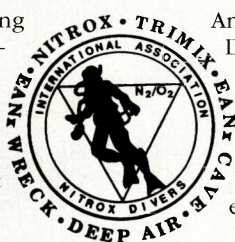
Nemesis Dive Computer

Outer space technology has found an inner space application. Cochran Consulting, Inc., a developer of dive equipment for NASA's astronaut training programs, has released a hoseless air-integrated dive computer for the recreational diver. While air integration may seem like a small step for dive computers, hoseless technology is a giant step for diver comfort and streamlining.

This easy-to-install and easy-to-use dive computer has two components: the controlling tank unit which screws into your high pressure port and a wrist unit that receives and displays the wealth of

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Product Information 55

TEST DIVE

information broadcast by the tank unit.

It took only a minute to install the tank unit during a boat ride to the reef, after which I simply tapped it three times to activate it. This tap-start design allows the casing to remain free of control points that could leak and flood the internal electronics. A series of audible beeps confirms start-up.

The tank unit clips easily to your low pressure BC inflator hose keeping it well out of your way but well within the 3 1/2 foot range necessary for the wrist unit to receive its signals. The wrist unit offers a large display held in place by a sturdy velcro strap, and activates with the push of a button.

A small magnet in the button triggers an internal switch again eliminating the need for a case penetration. The magnet is strong enough to interfere with your compass so you'll want to wear the compass on the opposite wrist or attach it to your BC. This minor inconvenience is more than offset by the elimination of the high pressure hose and some of the unique features of the Nemesis.

One of those features is constant calculation of your breathing parameter

(BP). This function measures the amount of air in PSI you consume per minute at the surface. By converting the rate to a surface equivalent, you can compare your air consumption on various dives regardless of the depths reached. The BP read out is available at any time during your dive with a touch of the wrist unit button and is a useful tool for those seeking to improve their breathing efficiency.

In addition to bottom time, depth, temperature and tank pressure, the Nemesis displays either air time remaining or no decompression limits (NDL) depending on which limit is less. NDL are based on a modified Haldanean model utilizing 12 compartments and provide middle-of-the-road limits. Neither the most conservative computer on the market nor the most liberal, the Nemesis is perfect for recreational applications.

Once back on the surface, your computer will begin to scroll available depths and times for repetitive dives. During your surface interval, you can also access the Nemesis logbook mode which will give you the dive number,

maximum ascent rate, average water temperature, bottom time, ending tank pressure and maximum depth. With the push of a button, you can access your worst case reading of remaining air, no decompression or decompression time, breathing parameter and average depth for the dive. The Nemesis stores 350 dives.



If you were to exceed a NDL, the computer will sound an audible alarm and provide you with a ceiling depth and total time required to complete your decompression. The maximum functional depth of the Nemesis is 190 feet and the computer compensates for alti-

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TEST DIVE

tudes up to 15,000 feet.

Batteries are user-replaceable. The tank unit operates on four alkaline AA batteries while the wrist unit operates on a single six-volt lithium battery.

An optional DCI-I personal computer interface is available to download dive information. Accessible log information includes date and time, dive number, starting and ending tank pressures; bottom time; average and maximum depths; surface interval; minimum and average breathing parameter; altitude; time to fly; and whether the unit was used in salt or freshwater.

This interface also offers graphic representations of your dive. While most computers store this information every three minutes, the Nemesis records the information every four seconds to provide a very accurate graph of depth and tank pressure. Graphic representations of each of the twelve tissue compartments are also displayed. In addition, the interface can also be used to change the Nemesis from imperial to metric unit measurements.

Most divers don't consider their console and high pressure hose a nuisance because they've had one since their first open water training session. But this is one habit you'll enjoy breaking. Even if you normally clip your console close to your BC, there's no comparison to eliminating it completely.

For more information regarding the Nemesis or the name of a dealer near you, call (800) 856-3483.—*Vince Rhodes*

Poseidon Odin

Imagine yourself on a stairclimber, going for a really big workout. Your heart rate is way up, your muscles are burning and your breaths are coming

liters a minute because of the increased pressure. That's an awful lot of breathing gas for a regulator to deliver, but if you were using a Poseidon Odin, you'd still be at only 23 percent of the unit's rated maximum volume!

When considered from this perspective, one can truly appreciate the Odin's massive 1,800 liter a minute capacity. It also explains why this regulator has long been the trusted workhorse among commercial and technical divers.

Poseidon Industri was founded in 1958 as a manufacturer of scuba diving regulators and related gear. The company's first single hose regulator, the Cyklon 300, was introduced in that same year. A testament to its excellent design, this regulator remains virtually unchanged today (except for soft goods) and continues to earn some of the US Navy's highest performance ratings.

Poseidon's most recent design is the Odin, which was introduced in 1986. The new regulator eclipsed the already outstanding performance of the Cyklon and went on to gain widespread acceptance for use in extreme situations involving high work loads or very cold water.

The Odin is based in a Venturi assist balanced diaphragm first stage. As with all diaphragm regulators, the unit is sealed against water and contaminant entry. An optional anti-freeze cap is the only addition necessary for extremely cold water use.

Two features do make this first stage rather unique. The first is the Venturi assist port, a Poseidon innovation that allows interstage pressure to remain much closer to the 152 PSI lockup value during the inhalation cycle — thus delivering greater air volume. With traditional first stage designs, either piston or diaphragm, interstage pressure normally



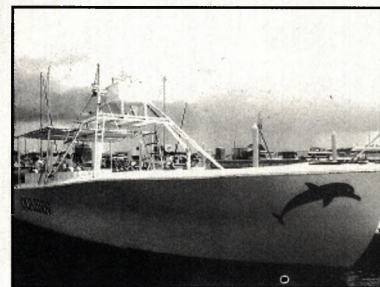
fast and furious. You may be breathing as much as 60 liters a minute.

If you tried to work that hard at a depth of 200 feet (not a safe practice by the way, especially on air) your breathing rate would jump to a whopping 420

drops 25 or 30 PSI during inhalation and is followed by a one or two second recovery period.

The other difference in this first stage is the high pressure seat. Most high pressure seats work against a so-called

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Product Information 67

TEST DIVE

cookie-cutter orifice and, while effective, this eventually destroys the seat material, sometimes before the annual maintenance is due. Poseidon has avoided the wear point by using a soft seal. This works much like a bathtub drain plug with the soft seat resting against the smooth interior of the high pressure opening.

The Odin second stage is an upstream pilot valve design that eliminates poppet springs and seats. Historically, upstream valves have gotten a bad rap due to their potential for demand failure if the first stage were to send too high an interstage pressure. Poseidon has eliminated this possibility by locating a pressure bleed-off vent in the end of the second stage hose. In the unlikely event of a first stage malfunction, the second stage will continue to provide the user with non-freeflowing supply of air.

The Odin second also features an angled side exhaust port. Besides directing exhaust bubbles away from the diver's face, this helps prevent accidental purging from use in high-flow water conditions such as surf, springs or DPV riding. One additional benefit to this design is the ability to pass the regulator to an out-of-air diver in either direction since there is no "up or down" as with normal exhaust tees.

Due to the very high performance nature of this regulator, a simple "plus/minus" desensitizing switch is located next to the mouthpiece and, as I quickly discovered, is very useful in preventing free-flow during water entry. I found the Odin to be a smooth performer with no surprises.

Like other servo seconds, I noticed a subtle popping at very low inhalation effort that disappeared as a full breath was drawn. The effect is so minor that many of the Odin users I spoke with were completely unaware of it, as was I after just a few minutes in the water. All in all, the Odin is a simple, well designed and rugged air handler. Divers needing extreme performance due to high work loads or cold water conditions should give the Odin the serious consideration it deserves.

The Odin comes complete with a "no tools needed" 200 bar yoke adapter, a hex key wrench to handle the 4 LP ports and 1 HP port, a carrying case and a limited lifetime warranty. For more information, contact your local dive shop or write to the U.S. distributor: Parkway/Poseidon, 241 Raritan Street, South Amboy, NJ 08879. — Tom Turner

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Equipment

HEAD TO HEAD

Fit is the most critical element of wetsuit performance



BACKGROUND: F. STUART WESTMORLAND

Let's face it, wetsuits aren't exciting. Unlike regulators, which have lots of moving parts, technical specs and performance criteria, or air-integrated computers, which have an ever-increasing array of bells and whistles, wetsuits are just... wetsuits.

Until you spend a dive cold and shivering. Then wetsuit fit and performance suddenly become a priority.

It was a growing priority for me as I contemplated spending another winter dive season in my four-year-old cold-water suit. The veteran of hundreds of dives, including a number of very deep dives, my favorite quarter-inch full suit had patches on its patches and was crushed nearly to the point of neutral buoyancy.

Clearly, it was time for a replacement, and I decided not to be a cheap-skate, but instead to treat myself to the best-made, best-fitting wetsuit I could buy. Maybe I'd even go for a custom suit!

I figured I'd use my connections as a journalist to make a few phone calls and get the real low-down on which

material was best and which manufacturer could make a custom suit to my exact specifications. After talking with sales managers, plant managers and wetsuit designers at most every wetsuit manufacturer and neoprene distributor in the business, I had more than 40 pages of detailed notes.

But rather than narrowing my choices down to one "ultimate custom-designed suit," my research instead gave me a greater understanding of and appreciation for the products already on the market. Many of the folks I spoke with echoed similar opinions, so rather than quote each and every one (sorry guys), I'll try to summarize what I learned.

First, let's define custom. A lesser number of suits are truly "one-off" products in terms of materials and design, but the majority of custom work is done to tailor an existing "stock" model of a particular wetsuit to accommodate persons who don't fit the standard pattern.

Manufacturers typically find they can fit 90 percent or more of the public with a standard line of sizes, but many

also offer the custom-fitting option to take care of that lesser percentage.

One reason that modern "stock" suits can be so accommodating is because many are made with a new generation of neoprene that has more stretch and resiliency than materials of a decade ago. In addition, wetsuit companies have borrowed from the garment industry, and tend to follow fairly well-defined patterns.

At the smaller end of the size range, suits typically have more of an "hour glass" shape, while larger sizes give proportionately more room in the midsection and thighs, since many large divers carry more mass in those areas.

That fact gives a good indication of who might need custom fitting. Short and stout divers, extremely thin or heavy divers, and large, yet muscular individuals — particularly body builders — are all prime candidates for custom fittings. Women with bust and hip proportions that differ significantly from the "norm" may also need custom fittings.

In the more extreme cases, a diver will recognize the need for a custom fit even without trying on a standard size. But there are a lot of borderline situations where custom tailoring could add a significant degree of comfort and warmth, and that's where a fitting and some advice from knowledgeable dive store personnel can be valuable.

When trying on a wetsuit, the most critical areas of fit are in the small of the back, under the arms and across the chest. A suit that leaves excess material around the kidneys or the armpits will allow cold water to circulate and rob heat from these critical areas. On the other hand, a suit that is too tight across the chest will restrict breathing and cause discomfort during the dive.

Divers with longer arms, legs or torsos may also find that a suit that is an

One reason that modern "stock" suits can be so accommodating is because many are made with a new generation of neoprene that has more stretch and resiliency than materials of a decade ago.

HEAD TO HEAD

otherwise good fit is too short at the ankles and wrists or too constricting at the shoulders. In any of these cases, a custom fitting is probably in order.

While most wetsuit companies employ skilled workers to cut and stitch a custom suit, the quality of the fit is only as good as the measurements taken at the time it is ordered. Various manufacturers offer training seminars, detailed instruction manuals and sizing charts to help store personnel take the best measurements possible.

As a result, most can boast very low return rates on custom orders, often as few as one in 100 custom jobs has to be sent back for corrections. To ensure that you aren't one of the few who have problems, make sure the store you are dealing with has a person or persons who are qualified and experienced at measuring for custom fittings.

The actual cost of having a particular brand and model of wetsuit custom-made to your measurements can vary considerably. Most manufacturers add

some additional charge to cover their time and labor, perhaps ten to 25 percent of the overall price of the suit.

Retail stores may or may not add an additional service charge, depending on the basic margins their sales strategies allow. Retailers may be more willing to reduce or eliminate this fee if you are a valued customer with some degree of buying loyalty at that store.

And so, in the majority of cases, ordering a "custom suit" is not a matter of elitism, but rather a convenience that will ensure a proper fit and a more comfortable dive. There are a lesser number of cases, however, when a diver really does want a specialty suit to fit unique diving needs.

A working diver, for example, may want extra chafe protection on knees, elbows and other points of contact, or extra material thickness in key areas. Those engaged in regular deep diving might want a stiffer grade of neoprene, while photo models might want a suit with certain colors or logos worked into the construction.

There are a number of smaller custom shops who will accommodate such needs, and some will actually create a unique pattern for a single suit. As one would expect, the price of such work is proportional to the materials and effort involved.

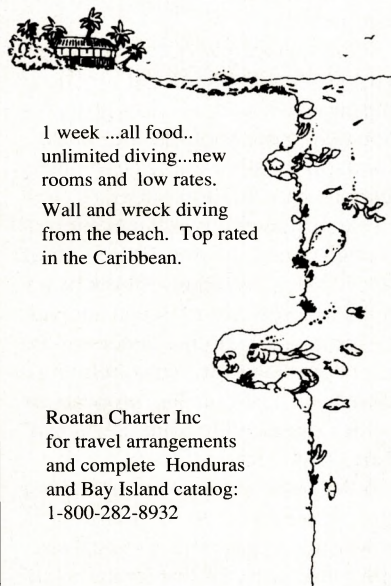
For the vast majority of divers, the best option is to visit a reputable dive store when it comes time to replace a wetsuit. While there are a number of mail-order firms offering inexpensive suits by mail, it's impossible to determine quality or fit without committing money up front.

Dive stores may carry a number of local and national brands of suits. There are endless variations on the basic neoprene formula, and an inquisitive buyer can quickly become swamped in technical details on the chemistry and manufacturing process. In the end, however, the most reliable indication of quality and durability is the recommendation of friends and the reputation of the manufacturer.

Once a brand, style and thickness are decided upon, divers should first see if an in-stock suit will fit them properly. If a custom-fitting is required, divers should be willing to pay a reasonable surcharge for the extra service, because in the end, the additional time and expenditure involved in a special order will result in significantly more comfortable dives. — *Pierce Hoover*

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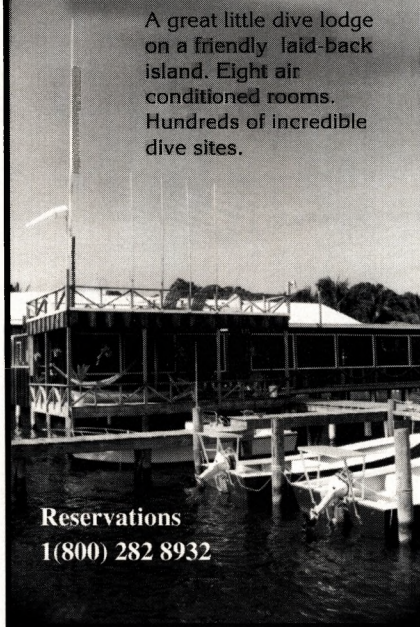
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*A warm suit is every cold water
diver's dream*

Water Heaters

Warm and comfortable. It's the dream of every diver in cold water or on long-duration dives. I recently had the good fortune to evaluate Repetitive Diver's new Wet/Dry Suit Heater, and this dream came true.

The application I used was diving wet (in a wet suit) on a long duration cave dive with a 90 minute decompression. In the 70 degree F water, I was comfortable throughout the dive and did not plug in the heater. In fact, the battery to the heater was left attached to my decompression bottles.

**BY TOM
MOUNT**

Once at rest on the decompression stop, however, the cold began to set in after about 25 minutes. I plugged the wet suit heater in and was surprised at how quickly warmth returned.

I was skeptical that the heater would provide warmth for the entire decompression. However, not only did I remain warm for the duration, but I actually

turned the heater down a notch about 60 minutes into decompression. In addition to being content and cushy warm, I discovered that the muscles in my lower back did not tighten up as they generally do on a long decompression stop.

On a different day, I loaned the heater to editor Pierce Hoover when he showed up for a cave dive with a wet-suit so crushed that it practically sank. Without the heater, he had shivered so hard on a previous decompression that he almost shook a stage bottle loose. Fitted with the Repetitive Diver heater, he enjoyed a warm, safe decompression, and says he might be able to squeeze a few more dives out of that old suit. *[Not true, that suit has since been retired at the insistence of my dive partners — Ed.]*

I have been so impressed by the heater that I have now installed a through-suit connector into my DUI dry suit as well. Who knows how long one

may remain warm in a heated dry suit. There's another benefit to adding a heater to a drysuit, as the extra heat could make a big difference in comfort or even safety if the suit ever flooded.

The Repetitive Diver heater is the brainchild of Mark Ownes and Clayton Bohm, two Missouri-based divers who spend a lot of time in cold spring and quarry water in the early spring and late fall. "We were sitting there on a cold deco stop one day when Mark wrote on his slate 'why doesn't someone make a drysuit heater,'" recalls Bohm.

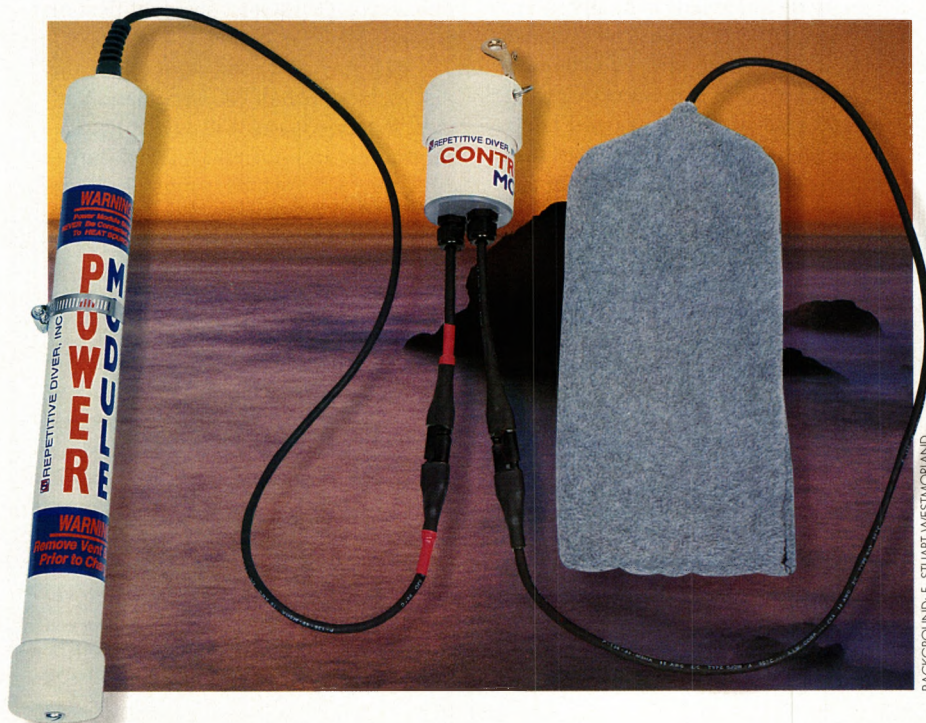
After two years of research and development, the final product was introduced in late 1993. The heater actually consists of three modular pieces: a battery pack, control unit, and heating pad. Waterproof connectors allow the unit to be connected and changed underwater (the manufacturers do recommend applying a light coating of anti-corrosion to the plugs if they are to be used in salt water).

Two sizes of battery pack are available offering one to three hours or three to five hours of heating time, both with temperature ranges from 95 to 115 degrees F. The smaller pack is 1.3 pounds negative, while the large pack is three pounds negative. The waterproof heating pad is controlled by a simple dial on the controller unit, and can be worn on the chest, stomach or small of the back comfortably.

Of the new products I have tested in the last ten years, the Repetitive Divers Heater is by far the most impressive. Who should purchase a divers heater? A simple answer is any diver who has ever been cold or plans to dive in cold water. I offer the highest recommendation to anyone contemplating this product, and also a sincere thank you to Repetitive Diver for making my dives and decompressions a whole lot more enjoyable.

For more information on the Wet/Drysuit heater contact Repetitive Diver, PO Box 35186, Kansas City, MO 64134. Phone or fax (816) 587-0917. ■

**I plugged the wet
suit heater in and
was surprised at
how quickly
warmth returned.**



BACKGROUND: F. STUART WESTMORLAND

Programmable Nitrox Dive Computer

Now you can use a computer that changes with your diving needs. Whether you're breathing air or some other blend of Nitrox, The Bridge from



Dive Rite Manufacturing, Inc. can adapt. This dive computer allows the you to program in an air dive or a Nitrox dive. Prior to descent, the diver simply scrolls and selects the appropriate percentage of oxygen from 21 percent to 50 percent.

The resulting no decompression limits displayed will represent the air or Nitrox mix selected. Gas mixtures may also be changed between dives.

The Bridge has audible alarms for decompression violations, rapid ascents and exceeding the limits of the air or Nitrox mix programmed for the dive. The unit's operational limit is 300 feet.

The computer also logs, profiles and scrolls no decompression limits for dives. And, you can upload your individual dive log and profile information to an IBM/Windows-compatible computer with the optional software and interface.

The Bridge will be available from your local Dive Rite dealer in Spring 1994. For more information, contact your local dealer or Dive Rite Manufacturing at (904) 752-1087.

Towed Underwater Video System

Check out a dive site before you enter the water. Now you can save valuable dive time and more precisely direct your underwater searches with the use of the TOV-1 towed video system from J.W. Fishers Manufacturing, Inc. The system is designed for clear water applications, but can be used in limited-visibility situations if towed slowly and close to the bottom.

A high-resolution 4 lux black-and-white video camera with an 8mm, 40 degree wide angle lens is mounted in a high-impact PVC housing. The camera is angled downward to offer simultaneous straight ahead and downward viewing. Two 100 watt tungsten halogen lamps provide illumination for the TOV-1. The unit also serves as a dropped video sys-

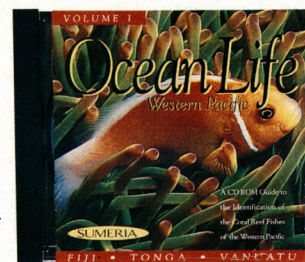
tem, allowing both straight down and side viewing.

The towed system has a 250 foot depth capability and includes leak detection circuitry and 150 feet of cable. Output can be viewed through a monitor or television with an RF converter. The system is powered by 120V AC and an inverter is available for operation with 12V DC. Other options are available.

For more information on the TOV-1, contact J.W. Fishers Manufacturing, Inc. at (800) 822-4744 or (508) 822-7330 or fax (508) 880-8949.

CD-ROM Field Guide

Who says that personal computers and water don't mix? Now you can get a glimpse of the underwater world while sitting at your terminal. Sumeria, Inc. has released *OceanLife: Western Pacific*, an interactive CD-ROM fish identification guide.



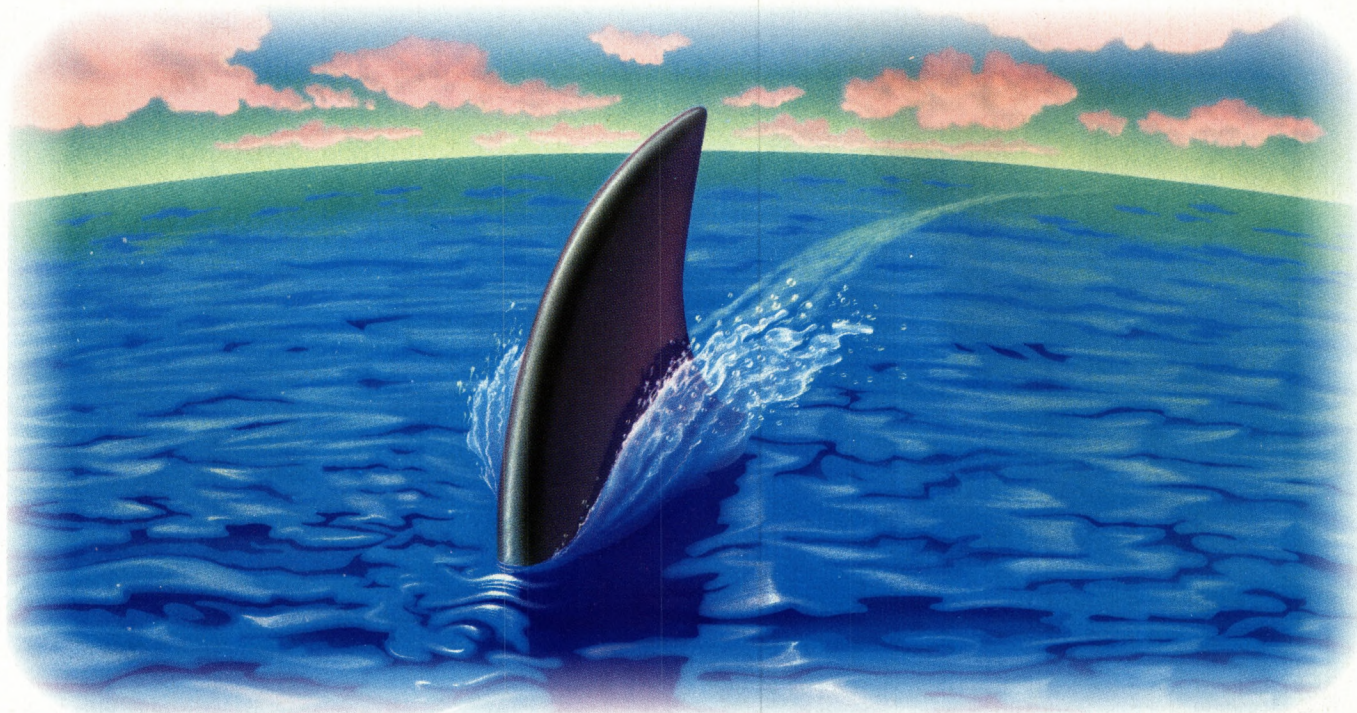
The first of a four volume set, this disc includes fish of Fiji, Tonga and Vanuata. Future editions will cover Micronesia, Hawaii and Australia's Great Barrier Reef. The CD includes original Quick-Time video of each creature allowing you to see its behavior and environment. Common and scientific names are included with a description of each creature and a map of its habitat range.

The *OceanLife* series can be run on either Macintosh or IBM Windows systems. Minimum requirements for the Mac include four MB of RAM, a 13-inch 8-bit color or grayscale monitor, System 7 and a CD-ROM drive. IBM minimum requirements include a 386 CPU, 256 color graphics capability, four MB of RAM, Windows 3.1 and a CD-ROM drive.

For more information on Sumeria's *OceanLife* series, call (800) 4-SUMERIA or fax (415) 904-0889.

BACKGROUND: NOBERT WU





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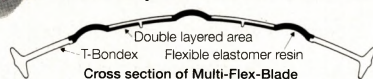
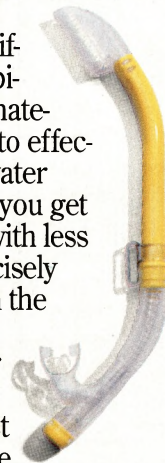
After a great deal of study and research, we

came up with the design for the Imprex fin. It is divided into three separate membranes that flex at different rates. A combination of different materials allows the fins to effectively channel the water while you swim. So you get greater propulsion with less effort. Which is precisely why you wear fins in the first place.

In addition to our fins, we also offer snorkels that are just as revolutionary. The Imprex Hyperdry snorkels do

just what the name implies. The top chamber diverts water away from the barrel, so you breathe air instead of water. And a choice of mouthpiece sizes give you the perfect fit.

So if you're looking for fins or snorkels, look to TUSA. Because really, your greatest fear when it comes to diving or snorkeling should be inferior equipment. And with TUSA, you'll never have to give it a second thought.



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D E S T I N A T I O N S



M. TIMOTHY O'KEEFE

Springs Break

Fresh water diving doesn't necessarily translate into "cold" and "murky." The crystal clear spring waters of Florida offer consistently good conditions and plenty of variety.

B Y V I N C E R H O D E S

Although the briny taste of your regulator may conjure fond memories of your last ocean excursion (after you finish gagging, that is), salt residue can kill your equipment. Almost every open water and equipment manual on the planet recommends a fresh water rinse of gear after dives. So, why not soak away the salt in the gin-clear waters of a Florida spring?

Whether you live in or out of the state, you're almost guaranteed to pass one of Florida's many fresh water springs on the way home from an ocean excursion. What better reason than "proper maintenance" to justify a quick stop for

a few more dives. There may not be reefs or dolphins, but there's no shortage of sites or sights.

If you're not buying the gear-responsibility rationalization, consider stopping at these locations for a training, check-out or brush-up dive on your way south. These plentiful, easy-access locations are great spots to hone buoyancy skills and become familiar with new equipment. Even veteran divers can benefit from getting a few "practice" dives under their belts.

It would be impossible to list every spring in the state of Florida. So, we've narrowed the list down to a few of our

favorite sites that lie relatively close to the main routes of I-75 and I-10.

DEVIL'S DEN WILLISTON, FLORIDA

Devil's Den is a wet paleontologist's dream (or vice versa). As you swim around the sink, you will notice hundreds of fossilized sea biscuits and shells embedded in plain view in the walls, floors and ceilings. Look closely along a ledge and see even more fossils.

The bones of an early man dating back to 7,500 B.C. were also found in the Den. And agencies such as Florida State University and the Smithsonian Institution have collected sabre-tooth and mastodon fossils and found them to be from the Pleistocene Era — dating back from 10,000 to two million years.

But you don't have to be a scientist or geology buff to appreciate the beauty of this dive.

Described by instructor Ginnie McKnight as an upside down mushroom, the dive offers twice as much as the open water area shows. And there are plenty of swim-throughs and rock ledges to keep divers busy. As you peer over ledges or into fissures, don't be surprised to see the occasional catfish. There are also a few bream that congregate in the open water area.

Although there is a cave system, it has been grated off for the safety of the divers coming to the Den. However, for trained cavern divers, there are a couple of fissures worth exploring and two air pockets.

To reach the water, divers gear up at the surface and descend cement stairs built into a solution tube to reach the interior of the sink. After descending another set of stairs to the wooden deck, entering the water is as easy as a giant-

Many divers visit the caverns and caves of Ginnie Springs.

There are literally hundreds of fresh water springs and sinks throughout the state of Florida. Many offer easy access and great diving. Temperatures hover at a constant 70 degrees F or so and, there's always plenty to see. Whether it's fishwatching or fossil hunting in the headspring or cavern and cave exploration, this gin-clear water has a magical appeal that few will be able to resist.

DESTINATIONS

stride or backward-roll. In fact, ease of accessibility makes Devil's Den a great location for training dives. A platform with ascent line is conveniently located in the open water area of the sink.

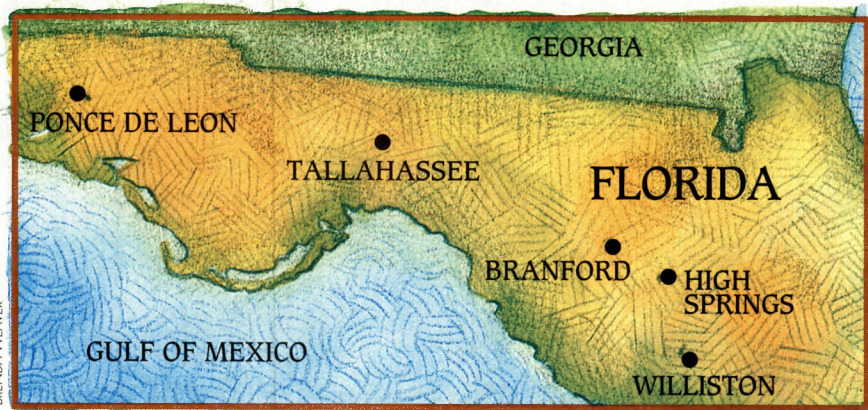
Depending on the amount of rain, the depth ranges from 45 to 55 feet. Diving is available every day of the year except Christmas. Night diving is also available, but arrangements must be made prior to your arrival. The water remains a constant 72 degrees F offering great diving year around. If you visit in winter, you may see how the location got its name.

"During winter, the cold air hits the warmer water and forms steam," explains McKnight. "The early settlers saw all this steam rising up from a hole in the middle of a corn field and nicknamed it Devil's Den."

With a rustic and secluded feel, Devil's Den is a great place to spend the day. Non-diving activities include volleyball, swimming and fishing. A picnic area with shelters is supplemented with barbecue grills and a large, clean bath area which includes hot-water showers.

The diving services are top-notch and the friendly staff is always waiting to help out. Air fills and rental gear are cur-

rently available and even more services will be offered when the Devil's Den opens its on-location dive store. Also, a scuba school offering PADI, NAUI and CMAS certifications ranging from open



water to divemaster will soon be open.

A new open water diving area is also in the works on the property. Created from an existing rock formation, the area will include a botanical garden and waterfall. The water should be crystal clear and about 30 feet deep.

For more information on Devil's Den, call (904) 528-3344 or write Devil's Den, Inc. at Route 3, Box 23-DD, Williston, FL 32696.

TROY SPRINGS BRANFORD, FLORIDA

The trip to Troy Springs is worth it for the boat ride alone. Land access to this deep, open water spring was closed

in 1990 making it approachable only from the Suwannee River. But after hearing all the hype, we figured it had to be worth the extra preparation. We were right.

The temperature of the water hovers at a constant 70 degrees F. And according to Gene Broome, owner of the Branford Dive Center, Troy Springs is the deepest open water spot in northwest Florida, making it an excellent location for training dives.

We boarded Broome's pontoon boat for the 15-minute trip upriver to Troy. You can't beat the Suwannee on a sunny day and the cypress-lined river banks made for a pleasant boat ride. We anchored right at the edge of the head pool and made our entry directly over the 80-foot drop off that is Troy Springs.

While diving the circular spring, there's plenty to see. An occasional albino crawfish and fossils hide in various crevices and corners around the spring. A good flow keeps the water clear and there is a large cavern area at the back of the spring.

Broome says this area of the Suwannee is also good for relic hunting. "There are a good bit of settlers' artifacts to be found," he explains. "This was a very important docking area for paddle-wheelers as they traveled to the Gulf. It was a distribution point."

For those who want to come face to face with history, they need only swim as far as the spring run of Troy. The timbers of a Civil War wreck jut out of the sand in the four- to six-foot depths. The steamboat, *Madison*, was scuttled in 1863 by her captain who abandoned the boat to head for Virginia and lead a company of confederate soldiers. The



Formed when the roof of an underground cave collapsed, Devil's Den offers great diving all year long.



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DESTINATIONS

remains of a 145-foot long sidewheeler can also be found in the Suwannee just to the side of the spring.

Another advantage of diving Troy Springs is its proximity to other sites. The town of Branford is central to many other great open water and cave dives including Little River, Peacock Slough, Orange Grove Sink and Ichetucknee Springs and River.

The Branford Dive Center is a full-service operation providing equipment rental and sales, air and nitrox fills and instruction including cavern and cave courses. Lodging is also available for groups of up to 52 people.

For more information on Troy Springs or the Branford Dive Center, call (904) 935-1141 or write P.O. Box 822, Branford, FL 32008.

GINNIE SPRINGS RESORT HIGH SPRINGS, FLORIDA

It could be called the Mecca of U.S. fresh-water cave diving. Mention Ginnie Springs and many a veteran caver has to suppress an urge to bow in the direction of High Springs. But don't write Ginnie off if you don't have your cave card. There's plenty for an open water diver to see and do.

In addition to head pools with plenty of fish, there are some user-friendly caverns waiting to be explored. It may be just the introductory experience you need to decide whether or not cave and cavern diving is for you. But beware, take a peek into the Ballroom and you may catch an incurable disease — cave fever. The only treatment is continual exposure to submerged passages.

The high water flow out of the springs ensures that the water is always transparent and a constant 72 degrees F. No matter what the time of year, you're sure to encounter good diving conditions — something few ocean operators can guarantee.

The main attraction is, of course, Ginnie Spring itself, which emerges from a cavern known as the Ballroom. Open water divers can follow the large safety line to depths of 58 feet at the grated source of the waterflow, and can spend an enjoyable dive searching the crevices and ledges of the Ballroom.

In addition to Ginnie, the resort also encompasses Devil's Eye, Devil's Ear and Dogwood Springs, as well as more than a mile of waterfront along the Santa Fe river. With this many options, you'll never get tired of the diving here.

But don't worry if you decide you

DESTINATIONS

want to stay. There are comfortable accommodations such as the High Springs Country Inn (formerly the Sunset Motel) nearby and a large campground with electric hook-ups on-premises. With the Santa Fe River flowing peacefully through this 200-acre wooded area, Ginnie Springs Resort has an idyllic setting to match its spectacular diving.

The resort also offers other important features such as cypress decks at the springs to aid entry, covered pavilions, picnic tables and grills, two large bath-houses with hot water and a full-service dive shop. The dive store has a large selection of gear for sale or rent at reasonable prices as well as a selection of food and drinks to cure the inevitable post-dive hunger pangs. The store can pump a variety of tanks including high pressure tanks commonly used for cave penetrations.

In addition to its retail operations, Ginnie Springs Resort offers an extensive on-site training program. From resort courses and open water certifications to full cave courses, Ginnie can meet the training needs of any dive enthusiast. There aren't many places that you can meet in a comfortable classroom for training lectures and then shuffle down the road to a premier dive site.

For the non-diver, there are plenty of other aquatic activities including canoeing, swimming, snorkeling and tubing down the Santa Fe. And for those that prefer to stay high and dry, volleyball courts and riverside nature trails offer a pleasant diversion.

For more information, call Ginnie Springs at (800) 874-8571 or (904) 454-2202. Or, you can write to 7300 NE Ginnie Springs Road, High Springs, FL 32643.

VORTEX SPRING PONCE DE LEON, FLORIDA

Located in the panhandle of Florida, Vortex Spring offers a unique attraction — artificial caverns. As strange as it sounds, it's true. In an effort to keep untrained divers out of the natural caves found here, the owners added a little something to keep the curious busy.

These tunnels offer simulated stalactites and branching corridors that widen or narrow erratically. There's always enough natural light to see by and plenty of exits. For those that might be a little timid about overhead environments, this is the perfect place. It's also a great location for newly certified



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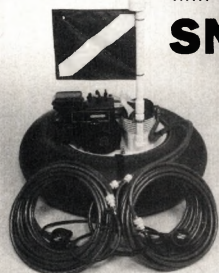
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DESTINATIONS

divers to hone their skills.

According to manager Joe Van Wagener, Vortex Spring is an ideal spot for open water training dives. Entries are made easier by docks with wide steps descending into the spring waters. Located at the 20-foot level in the clear, 68 degree water are training platforms with plenty of room for instructors and students to work on skills. There's also a "talk box" (artificial air space where divers can talk) that eliminates the need for surfacing to discuss minor training problems. And, the extremely large head-pool allows for long, controlled tours after each skills dive.

Another benefit of conducting training here is the proximity of great ocean diving. Panama City is just a short distance away with plenty of dive operators waiting to get you into the Gulf.

If you're looking for interesting fresh water critters, Vortex is the place for you. In addition to the usual bream and catfish, gar, carp and bass abound. And, don't be shocked to see a freshwater eel zip by in its race for a secluded hiding space.

If you're not squeamish and you're cave or cavern certified, you can see plenty of these harmless creatures. Just inside the cavern, an abundance of eels doze in crevices along the floor. It's a bizarre experience and one that will leave you strangely exhilarated.

At the mouth of the cave, the spring basin reaches a depth of 50 feet. Before you reach the steel grate 300 feet back

that blocks off the rest of the cave system, the tunnel meanders to a depth of 115 feet. Experienced cave divers can penetrate beyond this grate to a distance of 2,000 feet and a depth of 150 feet. A good flow issues from the cave and a permanent safety line has been installed so divers can always find their way to the surface.

Non-divers have a wide selection of activities at this spring, too. The swimming beach offers a nine-foot jumping and diving platform, a rope swing and a water slide. There are also volleyball courts, nature trails, canoes and paddleboats available.

If you plan to stay for a while, there are camping spaces and lodges available. The lodges range from large communal rooms to private rooms for smaller groups. Picnic tables, grills, electric hook-ups and restrooms with showers are also available.

Should you need anything else, you can most likely find it at the on-site general store or dive store. The campground store offers everything from camping supplies to canned goods to firewood. The dive shop also offers equipment for rent or sale as well as equipment repair and instruction. Courses range from basic certification courses to cavern and cave classes.

For more information on Vortex Spring, call (800) 342-0640 or (904) 836-4979 or write to Vortex Spring, Inc. at Route 2, Box 650, Ponce De Leon, FL 32455.



PAT CANOVA

Clear water and constant temperatures draw many divers to Ginnie Springs Resort. These conditions are common throughout the Florida Springs.



Wall dives, a trademark of all the Caymans, are particularly spectacular in Brac.

you want to do when you're not diving that makes the difference where you unpack your dive gear.

Grand Cayman offers many fine blue-water dives and many island distractions — luxury hotels, four-star restaurants, white-sand beaches, shopping galore, sunshine, beach bars.

Cayman Brac, as an alternative, offers incredible blue water diving, sunshine, white sand beaches, very comfortable accommodations, good food, a lot less tourists, a lot less congestion and a lot less wardrobe requirements.

Little Cayman, as a civilized antidote for too much civilization, offers the same incredible blue-water diving, sunshine, white-sand beaches, good food and accommodations, minimal tourists, and practically nothing to do when you're not diving or fishing. A clean T-shirt a day is as rigorous as your fashion requirements will get. Leave the make-up and jewelry at home, because, quite frankly my dear, no one will care.

Like Goldilocks sampling the three kinds of porridge, many divers prefer Cayman Brac — the one in the middle — the one that many think is "just right".

Cayman Brac is named for the islands' geographic anomaly — a 140 foot high bluff on the eastern tip of the island. Brac means "bluff" in Gaelic and this bluff offers a fantastic ocean view as well as a honeycomb of caves that once hid pirates and their treasures. Aye, matey, who knows what's left behind?

For lovers of the dive, Brac is a paradise of coral reefs, elkhorn coral gardens, great drop-offs, a scattering of shipwrecks and unusually good visibility. Expect abundant marine life — gliding Caribbean stingrays, toothy morays, garden eels that appear and suddenly disappear, shiny barracuda hovering below your dive boat, magnificent queen

Back To Brac

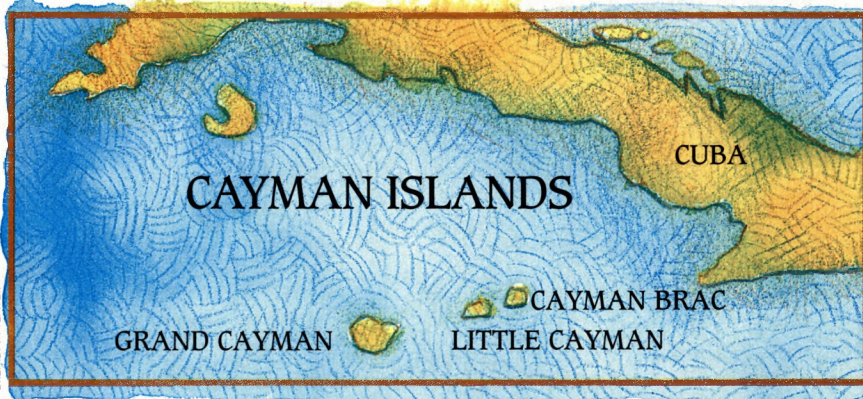
Find out why less is more at Cayman Brac and Little Cayman. These smaller sister islands to Grand Cayman offer some wonderful diving and few distractions.

B Y V A L E R I E M O O R E

No neon. No tie. No shoes. Just some of the best diving in the world. Lovers of the dive will fall in love with Cayman Brac for all the things it is — and perhaps more importantly — for all the things it isn't. (I use the term "lovers of the dive" instead of "serious divers". Because, after all, aren't we doing this for fun?)

For lovers of the dive, Cayman Brac is a little jewel in the Caribbean, 89 miles from Grand Cayman and five miles from Little Cayman, an even smaller, even quieter island jewel. Christopher Columbus stumbled upon the Caymans in 1503 and named them Las Tortugas for the large population of sea turtles he found there; and whose population he promptly began to decimate in an effort to keep his crew supplied with fresh meat on long ocean rides between the Old and the New Worlds.

Cayman Brac is the middle sister of the three islands, offering significantly less hustle and bustle than Grand Cayman and only a bit more land distractions than Little Cayman, which for all practical purposes, feels like a private island. For lovers of the dive, all three Caymans can be a paradise. It's just what



angelfish in luminous blues and yellows, bright butterfly fish, colorful wrasse, buck-toothed parrot fish, schools of snappers, grunts and curious groupers.

The Cayman Island "sisters", however, are most famous for their spectacular wall dives. The Caymans are actually the tops of submerged mountains and, as the divemasters like to say to encourage divers not to retrieve runaway gear: "You'll be back at the hotel eating lunch before your knife hits the bottom." Like a lot of things on these islands, you

just have to let it go.

Cayman Brac and Little Cayman are blessed with a variety and abundance of dive sites. Both islands lie on an east/west axis so the divemasters check wind and waves to determine whether the boats will go to the north or south side of the island.

Some of Cayman Brac's wall-dive sites on the north side are Airport Wall, Garden Eel Wall, East Chute and Cemetery Wall. The walls are known for their gloriously colorful sponges and unusual

topography — crevices and chutes and drop offs. South side wall dive-sites include Anchor Wall, after a large unidentified anchor in a crevice at about 90 feet that has now become a part of the coral walls. There's also Wilderness Wall, a favorite cruising spot for ocean-going pelagics.

Both sides of the Brac offer a diversity of shallow reef sites. Lighthouse Reef, Greenhouse Reef and Public Beach, on the south, to name just a few, give divers ample opportunity for up-close and personal encounters with nurse sharks, groupers and rays.

But for sheer spectacle and excitement, Little Cayman's Bloody Bay Wall is unsurpassed. Starting with a shallow reef only 15- to 20-feet deep, divers glide off the edge into a fantasy world with caves, tunnels and crevices to visit an incredible variety of fish, sponges, gorgonians, coral and pelagics. Cruising the wall ("flying" the wall might be more appropriate) while hanging over blue infinity with 150- to 200-foot visibility is about as close to heaven as a diver can get. This is where you will also gain a new appreciation for your dive computer.

The divemasters are very attentive and choose sites where conditions are most favorable for all levels of diving skills. One of the many drawing cards to the islands is that beginners and experienced divers can have equally good times at the many sites. And thanks to simple but effective conservation methods like permanent moorings, the Golden Dive Goose that is Cayman will not be sacrificed to short-term mentality.

Brac and Little Cayman are a photographers paradise. Bring your own or call your hotel to see if rental equipment, E-6 processing or professional guidance are available. The calm waters are extremely forgiving to divers whose cameras are permanent extensions of their hands. If you can't get the shot, it won't be because the current blew you away.

Non-divers may find the Brac and certainly Little Cayman a bit... well.... boring. While a diver will be inspired by this glorious underwater kingdom, a non-diver may get hammock burn-out from too many hours strung between trees. The larger Brac resorts offer swimming pools, snorkeling, tennis, and bicycles, lectures, slide shows — even TV. Call to be sure what amenities are available at the hotel of your choice. Mopeds are for rent on the Brac. You'll get a map that tells you where its safe



you won't have to go through hell to get there.

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DESTINATIONS

to go and where it's not safe to go — unless of course, you want to spend the rest of your dive vacation picking gravel out of your knees. Remember to drive on the LEFT and hope everyone else remembers, too.

Diving off the Brac is usually by boat, but shore diving is also a possibility. A smorgesboard of dive packages are available to keep your gills as wet as your profile will allow. Night diving is a wonder off the Brac and the difference between diving the same site at night

that you dove during the day is as different as... day and night.

Excursions from the Brac to Little Cayman run regularly, seas permitting. Seasoned divers (the ones with scratched fins and duck-tape bound dive bags) will find a secure seat and something to hang on to for the exhilarating ride over and back. If you are staying on the Brac, remember that the diving off Little Cayman is more than worth the few bumps over. An animated conversation over the engine whine with an interesting dive

buddy is the best cure afloat for motion sickness.

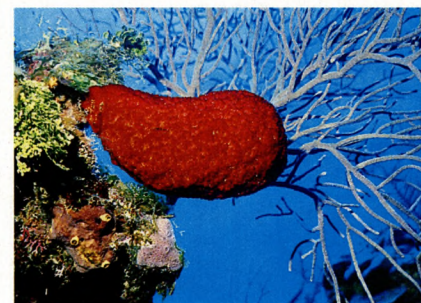
If there is one drawback to the quiet splendors of the Brac and Little Cayman it's getting there.

There are far worse places for a long layover than Grand Cayman, but face it, people want to get to their destination, kick off their shoes and settle in. If you do have a long layover in Grand Cayman, experienced travelers recommend packing shorts or a swimsuit in a carry-on and heading to the beach, packing credit cards and heading to the duty-free shops, tying on the feed bag to graze on local delicacies, or renting a car and driving the island (remember on the LEFT!).

For accommodations on Cayman Brac, choose from Divi Tiara Beach Resort with Peter Hughes Dive Tiara (800-367-3484); Brac Reef Beach Resort with Brac Aquatics, Ltd. (800-327-3835); Seafarer Condominiums (809-948-2265); Brac Caribbean Club (809-948-2266); Blackie's Seaview Hotel (809-948-8232); or the Brac Airport Inn (809-948-7423).

On Little Cayman there is Pirates Point Resort, Ltd. (809-948-4610); Southern Cross Club (317-636-9501); Sam McCoy's Diving and Fishing Lodge (800-626-0496); Village Inn (809-948-4673); and Little Cayman Beach Resort (800-327-3835).

For those who can't get enough diving and whose feet don't need to touch land, two live-aboards are available. The



DAN SHELL

Colorful sponge and coral growths are common on the walls.

Little Cayman Diver (800-458-BRAC) or the *Cayman Aggressor* (800-348-2628).

Travel advisory for this tropical paradise: the Caymans are on "island time." This means that the islands do not subscribe to the ulcer-producing pace that prompted you to go there in the first place. In other words, do not live by your watch — don't even take your watch. "Relax mon, relax" and enjoy some of the world's most spectacular diving.



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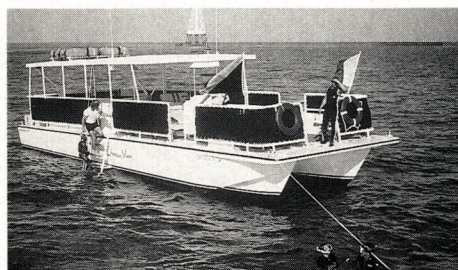


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KATHY DEWET

The Season For Shaw's Cove

Some spots are made for diving in winter. This Orange County site benefits from seasonal high tides and allows divers to view a wealth of marine life.

B Y K A T H Y D E W E T

The black rocky point extending seaward along the edge of the sandy cove is reminiscent of many inshore tropical reefs. Dip a toe into the lazily lapping surf, however, and you will quickly remember that it's winter and you are at Shaw's Cove in Orange County, California.

For the diver well protected in six millimeters of stylish neoprene, this scene beckons further exploration. The rocky fingers close to shore offer a shallow series of cracks and crevices loaded

with diverse marine life. The winter season brings some of the highest annual tides and, in the absence of a local storm, is the best time for exploring this labyrinth.

Shaw's Cove, located in North Laguna Beach, is one of Orange County's most popular shore diving destinations. A steep rocky cliff on the northwest rim of the small sheltered cove extends into the sea. Looking to the southeast, the famous tourist area of central downtown Laguna stands out against a backdrop of beauti-

ful green hills.

The reef begins right on shore in the splash zone, and tapers off in a gentle slope, merging with a sandy floor on its seaward edge at 50 feet. Although California diving is typically characterized by lush kelp forests, there are only traces of kelp at Shaw's Cove. The attractions of this site are generally calm surf, easy access over a sandy beach and meandering fissures that provide places of refuge and attachment for numerous marine organisms.

The fissures lead to the interior of the rocky reef, and become shallow and narrow in some places. Divers need optimal conditions to safely enjoy the alluring features of this reef.

A slack high tide on a day with little or no surf provides the best conditions for this dive. During conditions of low tide or moderate to high surf, avoid entrance into the fissures, because the forces of water moving through these

Meandering fissures provide places of refuge and attachment for a variety of marine organisms at Shaw's Cove.

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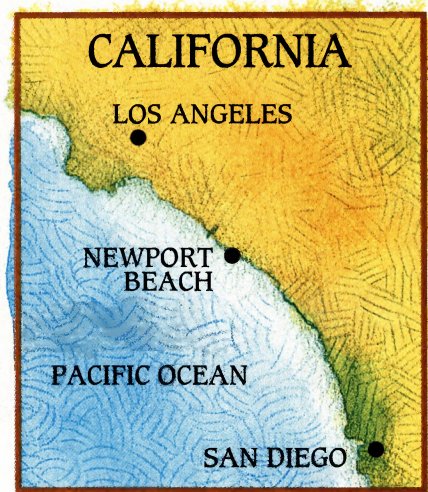
restrictive passages may render it unsafe for diving.

Don't be discouraged if the crevices cannot be entered. The perimeter of the reef also contains many points of interest, including branching gorgonians, green anemones, giant California spiny stars, blue-banded gobies, and gregarious garibaldi.

TIDAL CONSIDERATIONS

Some dives require consideration of tidal patterns. When planning a dive into the fissures at Shaw's Cove, knowledge of tidal conditions is useful. Extreme tides, known as spring tides, occur twice each lunar month.

The term spring tide, is derived from the definition of spring: the act or



instance of leaping up or forward. When there is only a slight change in the water level it is a neap tide, derived from the Anglo-Saxon word nepfold, meaning napping.

Throughout the year, the amplitude of spring and neap tides vary as the path of the moon's orbit around the Earth changes slightly each lunar month. Spring tides nearing seven feet are likely along the California coast from November through February. During these seasonal high tides, the shallow fissures at Shaw's Cove have excellent visibility and little surge. Only occasional winter storms alter these outstanding conditions.

Locating the system of passageways is simple. After an easy sand entry, one needs to snorkel only a short distance seaward before descending. With the reef located on your right-hand side, swim along the edge where reef and sand meet, and at a depth of 20 feet you will find the gap that is the entrance to the largest part of this labyrinth.

DESTINATIONS

The main passage heads west, eventually branching into several smaller channels that veer south returning to the open sea. The mouth of the gap, adorned with colorful red and purple spiny urchins, is a place of refuge for many juvenile garibaldis that swim about the spiny garden.

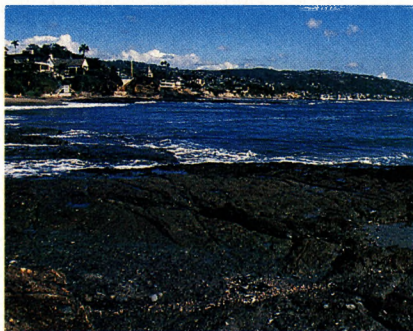
ABUNDANT INVERTEBRATES

Further into the system, urchins give way to encrusting sponges in blue, yellow, orange and white. The yellow sponge, *Verongia thiona* is the food source for the small mollusc *Tilodina fungina*. Closely related to a nudibranch, *Tilodina*, has a thin shell shaped like a limpet and a soft snail-like body colored yellow like the sponge it feeds on.

Although *Tilodina* is described as rare, it is a regular resident in the crevice. Spanish Shawl and Sea Lemon nudibranchs are common here as well. The use of a dive light can help a diver distinguish details, and illuminate these small inhabitants that otherwise might go unnoticed.

Surveying the narrow passages supplies the invertebrate enthusiast with continuing discoveries. Small clusters of delicate bryozoan and tube worms take shelter under ledges. Look closely here and you may find the eyes of a well camouflaged decorator crab peering back.

Not all of the animals are so elusive. Predatory ochre stars feed on surge-tolerant barnacles and mussels in plain



Shaw's Cove is located in Laguna Beach.

view. Anemones decorate the walls and floor of the passageways and vary from tiny pink corynactis to large white sea anemones.

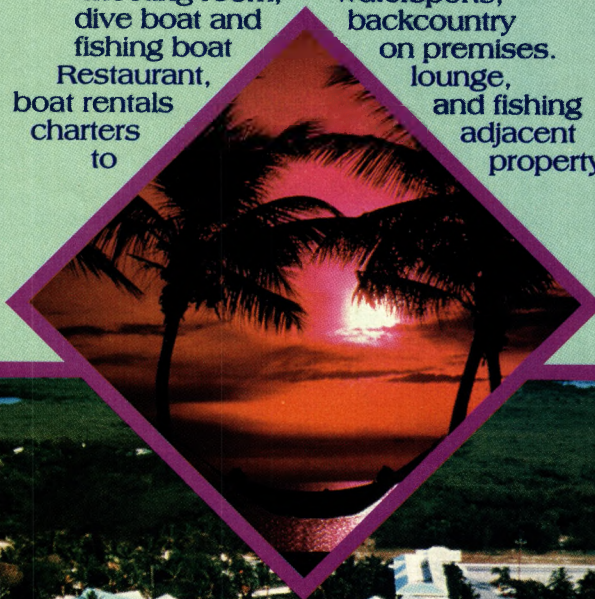
The white anemone is a color variation of *Anthopleura xanthogrammica*, the giant green anemone. The green coloration is thought to be due to the presence of a single-cell green algae that live



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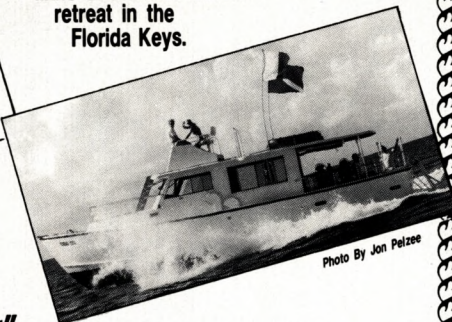


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DESTINATIONS

within the tissues of the animal. When found away from sunlight, such as in the crevices of Shaw's Cove, the anemone appears white.

AFTER DARK

This reef has a number of inhabitants that prefer darkness. These are the nocturnal animals like lobster, octopus, moray eel and red rock shrimp. In the dim light of the fissures, these residents are found during daytime. However, diving this site at night is easy, and can provide an even deeper appreciation of the reef's beauty.

As the sun sets, the reef begins to crawl with animals that appeared sedentary during the day. Chestnut cowries extend their mantles as they emerge to feed on sponges, tunicates, and even small anemones. Eels, that only showed their toothy smile by day, swim freely with graceful bodies up to five feet long. Octopi amble along on their eight arms readily changing the color and texture of their skin in the presence of a diver's light.

The access to Shaw's Cove is a foliage covered stairway at the end of Fairway at Cliff Drive, just one block from the Pacific Coast Highway (Highway 1) in North Laguna Beach.

Bring your non-diving friends and family on your excursion to Shaw's Cove. When the high tides retreat after your dive, the tide pooling is excellent and provides a great way of sharing your passion of life in the sea with loved ones that may not yet dive. Topside, during the remainder of your visit, the quaint town of Laguna Beach has as much variety and beauty to offer as the underwater reefs.

Whether by day or night, the fissures and surrounding reef at Shaw's Cove have much to offer. This dive is suitable for all levels of diving experience and is an especially nice for photography.

It's impossible to take in all the fascinating features and critters from just one dive. Consequently, Shaw's Cove is such a favorite with local divers that some try to visit on every available weekend.

Divers need to be aware that the cove is within the Laguna Beach Marine Life Refuge and some restrictions apply. By maintaining a conservationist attitude and abiding by the saying "take only pictures, leave only bubbles," this reef will provide pleasures for divers both today and in the future.

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All staff members are instructors and can answer most any question or help you with your gear problems. Nitrox 1 and 2 and air fills are also available on-site and Dick Rutkowski's Hyperbarics International is located just

downstairs. Rutkowski offers Nitrox and hyperbaric training.

While hauling your gear to the boat seems like the Bataan Death March at some resorts, that's not the case at Ocean Divers. *Big Red*, the operation's 55-foot catamaran, and *Ocean Diver*, a 50-foot single hull, are docked next to the gear rental area. Equipment lock-up is also available eliminating even the need to cart your gear to your hotel room. Both vessels offer plenty of space to assemble and don gear.

Once under way, you'll experience Ocean Divers strongest asset — its staff. Informative dive briefings include a thorough description of the site and the marine life you can expect to encounter. For the novice diver, there's plenty of assistance offered. And, novice and veteran divers alike will appreciate the fact

that they aren't talked down to.

When you return to the dock, refreshment's not far away. Also located in the Ocean Divers complex is Doc's Galley, which serves breakfast and lunch, and Gilligan's Dockside Bar. If your idea of rest and relaxation runs more along the lines of a soft bed or a freshwater dip, just amble back over to the hotel.

MARINA DEL MAR

These upscale accommodations are the perfect place to relax after your dives. Standard, studio and two bedroom suites are available. From most rooms you can look out over the marina. Pass the time catching z's in air conditioned comfort or head downstairs to soak up the sun.

Marina Del Mar's large freshwater pool and whirlpool is nestled in the palms and surrounded by a large deck. This is the perfect location to catch rays, socialize or just watch the boats go by in the canal. In addition to a clear view of the marina, you can also see a Key Largo tradition — Coconut's.

This indoor/outdoor restaurant and bar is a popular spot with locals and visitors alike. And while others have to drive to this hot spot, you're right next door. After a full night at Coconut's, you're just a short walk from your room.

The proximity and great service make Ocean Divers and Marina Del Mar a pleasant place to stay and dive on your Key Largo vacation. 

More Info

Marina Del Mar

P.O. Box 1050, Key Largo, FL 33037
(800) 451-3483 or (305) 451-4107
Fax: (305) 451-1891

Ocean Divers

522 Caribbean Drive, Key Largo, FL 33037
(800) 451-1113 or (305) 451-1113
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Product Information 48

R E S O R T R E P O R T

Sunset Beach

BY PIERCE HOOVER

A recent ad for a week-long diving vacation at Bonaire's Sunset Beach Hotel seemed too good to be true. It offered airfare, seven nights in a beachfront hotel, boat and shore diving and a number of extras such as a rental car, breakfasts, departure taxes and transfer fees...all for less than \$900.

Faced with the tough choice between a week's worth of copy editing and a trip to the Caribbean, I made what I was sure was the correct decision - and started packing my dive gear.

The "Bon-anza" package, which was arranged by Caradonna Tours, originates in Miami and is cheapest during mid-week. For a few extra dollars, you can take advantage of ALM's direct flights on Friday and Saturday evenings to avoid the airport transfer in Curacao.

Either way, you'll end up at the Sunset Beach Hotel, where you'll find three star accommodations adjacent to Bonaire's best natural sand beach. While the Sunset doesn't bill itself as a luxury resort, you'll find such amenities as room safes, cable, air conditioning and an international direct-dial phone system.

The open air bar and restaurant by the water's edge have the thatch-roofed charm that will make any tropical vacation fantasy seem complete, and Sunset's management has just added hot tubs, a pool and a new terrace restaurant.

But you're not here just to sit on the beach, you're here to dive Bonaire — which is everything the magazines and brochures claim it to be. With a coastline that has been designated as a marine park and sanctuary since 1979, Bonaire's reefs and waters remain in pristine condition. I was reminded of this fact as



soon as I placed a mask on my face and stuck my head underwater.

There, not 10 yards from the beachfront restaurant was a bonefish sneaking along the sand. A short swim with mask and snorkel showed a bottom contour typical of Bonaire: shallow reefs slope gently to about 30-foot depths, then plunge steeply to depths of 200 feet and beyond. Healthy hard and soft corals line these shelves and dropoffs, and the shallows hold an unusual abundance of juveniles.

After a warm-up snorkel, I reported to the Sunset Beach Dive Center, which offers morning and afternoon one-tank boat dives, along with night dives and unlimited shore diving. Schedules are refreshingly informal, with site choice determined by the dive group. I also found Walter Stark and the staff at the Dive Center to be unobtrusively friendly. Those who need help or request assistance are accommodated, and all divers are treated to low-key yet attentive service.

The Center caters to both European and North American divers, with a staff that speaks at least nine languages between them. In addition to basic and advanced certifications, the Center offers a number of specialty courses, including

an increasingly popular Underwater Naturalist specialty.

My dive package included six boat dives and unlimited shore diving, with extra boat dives available. I'd be inclined to take advantage of another upgrade that gives you extra days with a rental car to sample the abundance of excellent shore diving opportunities along Bonaire's coast line.

With unlimited air fills from the Dive Center, one could use the rental car to rack up some great bottom time. Just make sure you bring thick-bottom booties or sport sandals to walk on the tough "ironshore" rocks.

After a few days of boat and beach diving, followed by leisurely evenings against the backdrop of a tropical sunset, you may notice your blood pressure dropping. Bonaire has that effect on even veteran travelers, and the Bon-anza package is a great way to experience this phenomenon at a reasonable price. ▀

More Info

Caradonna Caribbean Tours
P.O. Box 3299, Longwood FL 32779
800-328-2288

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(No Feeding Required.)

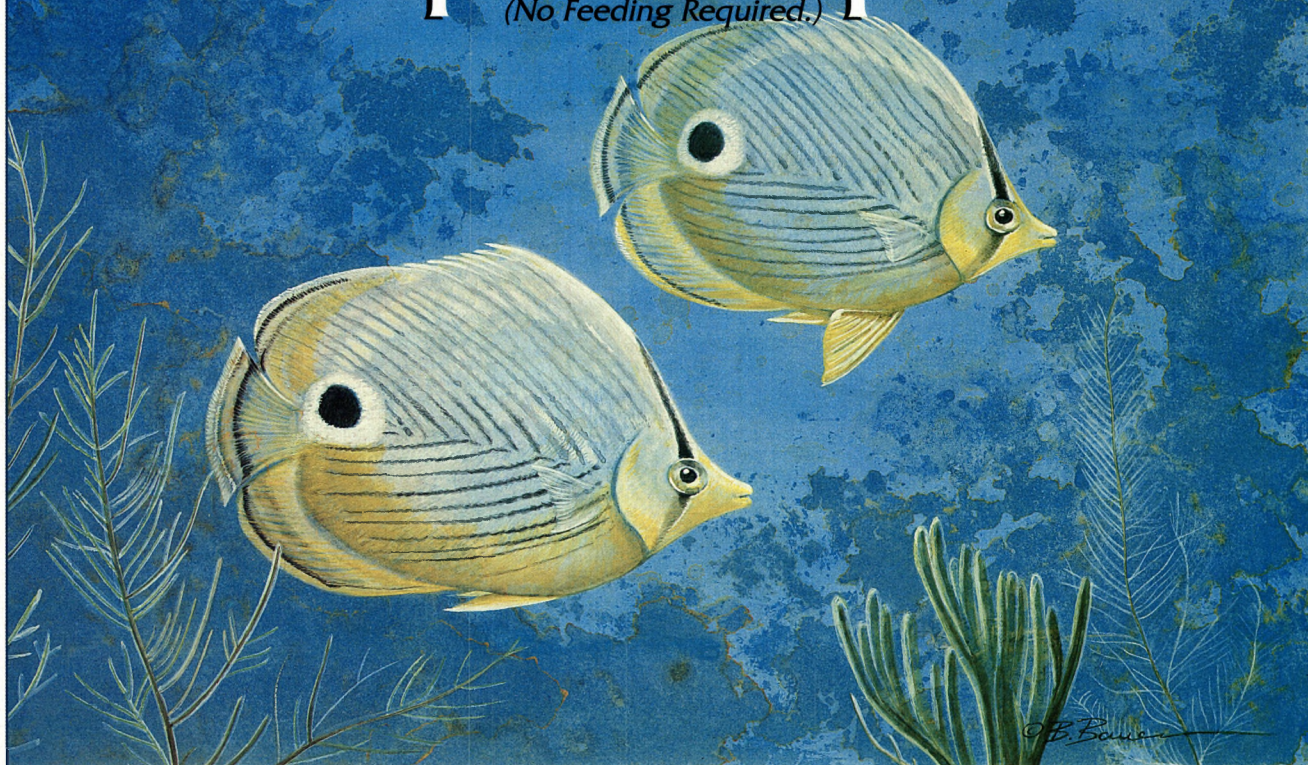


Image Size 17" x 11.5"

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A Special Limited Edition Offering for SPORT DIVER Readers

If you've had a close-up experience with four-eye butterflyfish like these, you know they're beautiful. And now, you can own a part of that beauty. Without the cost of maintaining a saltwater tank. (And go ahead, cancel your order to buy that Caribbean island surrounded by reefs. We're going to send these magnificent "ocean butterflies" directly to your home.)

As a *Sport Diver* reader, you have access to a limited edition of 500 signed, numbered prints, but only for a

limited time. Diver-artist Brent Bauer's other prints have gone fast — and these will never again be available, since the printing plates have been destroyed. Your print will arrive on the finest acid free paper, practically ensuring the immortality of your fish (how many aquarium fish come with that guarantee?)

Fifty artist's proofs are also available of this painting; please call early to reserve yours.

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Mail to: Jennifer McComb, Director, World Marine Art Collection, 330 W. Canton Ave., Winter Park, FL 32789
or FAX your order to 407-628-7061

Product Service Number 62

TRAVEL & INDUSTRY

Perrine Schedules Underwater Adventures

Professional underwater photographer Doug Perrine will be leading a series of expeditions in 1994. The first will be to photograph the whale sharks of western Australia, April 3-10, 1994. His next expedition will be to the far

northern islands of the Galapagos on May 21-31, 1994. Lastly, he will host four excursions to swim with spotted dolphins in the northern Bahamas during June - September, 1994.

For more information, contact Doug Perrine at Innerspace Visions at (305) 669-0118.

Video Course Aboard *Nekton Pilot*

Take part in a week-long video workshop sponsored by Ikelite/JVC and hosted by videographer Bob Rosser aboard the *Nekton Pilot* as she cruises the Tongue of the Ocean itinerary, March 20-27, 1994. All camcorders, housings, books and editing equipment are supplied by Ikelite Underwater Systems. Divers need only their dive gear to take the course, but are also welcome to use their own camcorders and housings. For more information, contact Nekton Diving Cruises at (800) 899-6753 or (305) 463-9324.

1994 Boston Scuba Symposium

The 1994 Boston Scuba Symposium, hosted by PDIC, is scheduled for April 23, 1994, at the Colonial Hilton, Wakefield, Massachusetts. Tickets are \$7.00 and may be purchased at the door on the day of the show, or in advance by writing to: Fred Calhoun, P.O. Box 291, Back Bay Annex, Boston, MA 02117. Show phone number is 508-897-0877.

Scubafest '94

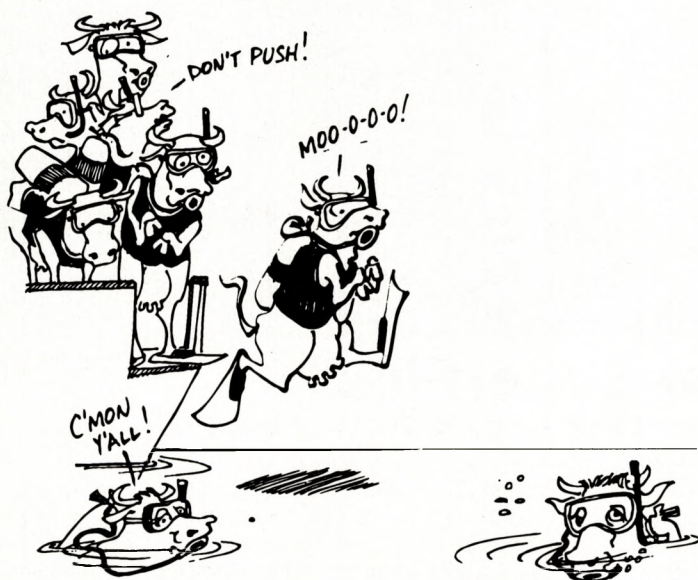
On February 25 - 27, 1994 the Ohio Council of Skin and Scuba Divers Inc. and the Gavia Scuba Club of Greater Cincinnati will host Scubafest '94. The three day affair will include seminars, workshops, contests, exhibits and social activities as well as dive store, manufacturer and travel agency displays. Proceeds will go to DAN, the OCSSDI scholarship fund awarded to students interested in furthering their education in marine awareness and to promote the sport of scuba diving.

For more information, call Gary Jacobs at (513) 863-3211.

Patch Project On *Caribbean Explorer*

Undersea photographer and marine naturalist Marjorie L. Bank has introduced the "Patch Project" aboard the *Caribbean Explorer*. The objective of this project is to expose divers to the myriad life forms that can exist in any small area of ocean reef, and to increase diver awareness in the marine environment.

For more information, call Explorer Ventures at (800) 322-3577. 

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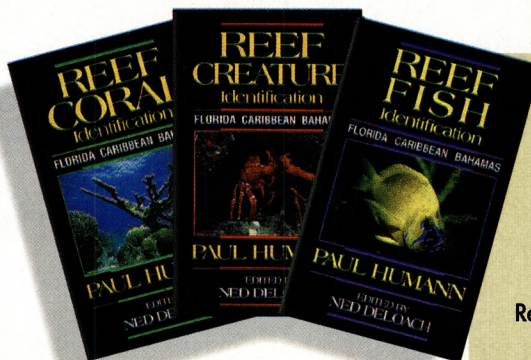
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Product Information 12

SPORT DIVER LIBRARY



THE REEF SET

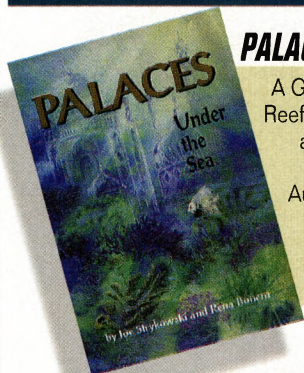
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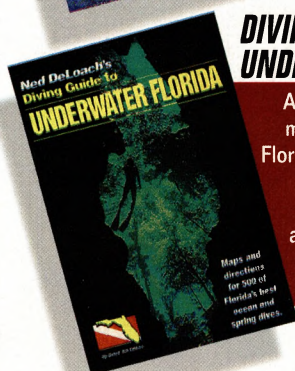
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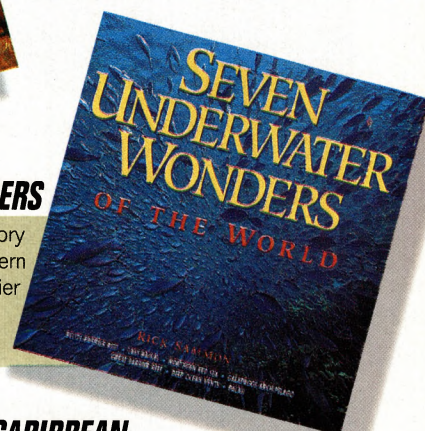
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If you love the ocean, this book belongs on your coffee table. Underwater photography genius David Doubilet presents a spectacular collection of his best images. 168 pp. hardcover **D6 \$39.95**



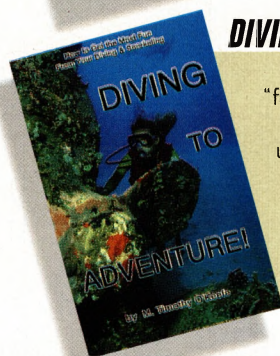
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A brand-new overview of the many diving opportunities in Florida's waters. This complete reference includes detailed descriptions of dive sites, area information, and maps. 324 pp. softcover **D7 \$16.95**



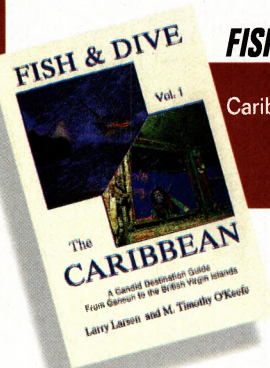
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A photographic masterpiece, exploring the story of the Belize Barrier Reef, Lake Baikal, Northern Red Sea, Galapagos Archipelago, Great Barrier Reef, Deep Ocean Vents and Palau. 180 pp. hardcover **D5 \$29.95**



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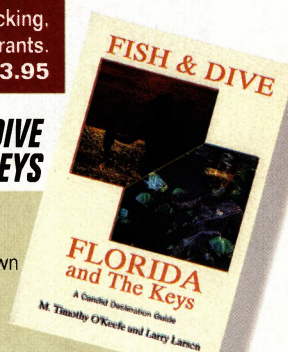


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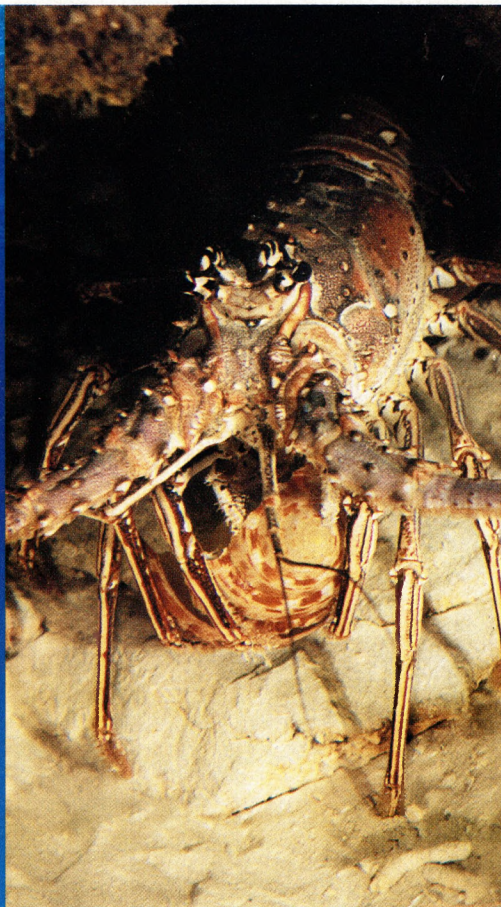
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Dive Log

*I had discovered a natural enemy of
one of the world's largest shells...*

BY COURTNEY PLATT



COURTNEY PLATT

DIVE LOG

Diver: Courtney Platt

Date: September 25, 1987

Depth: max 800 feet

Dive Site: Cayman Wall

Dive Boat: PC-1203 Submersible

Dive Location: Grand Cayman

I was piloting the PC-1203, a three-person submersible operated by Research Submersibles Ltd. We had begun an ascent after visiting the fascinating animals at 800 feet when I spotted a large Caribbean Spiny Lobster (6-8 lbs.) disrespectfully dismantling a five inch diameter Adanson's Slit Shell (*Entemnotrochus adansoniana*) at 630 feet. Adanson's Slit Shells are extremely rare and very valuable. There are presently only three dozen or so in museums and private collections around the world. It's considered a living fossil and was only recently discovered to still exist in waters more than 300 feet deep. Because this large snail lives on vertical cliff faces, it falls into deeper waters when it dies, and therefore has never been found on a beach.

Normally calm in my spiel, a verbal expletive slipped out which must have been damaging to my passengers' ear drums in our confined space. My adrenaline level was soaring as I quickly put us in position to document the event. The lobster had removed one side of the shell. When I returned an hour and a half later with another pair of passengers, the lobster had also removed the apex of the shell for the last bits of flesh there. I had discovered a natural enemy of one of the world's rarest shells and caught it red handed.

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And we even equipped the Oasis 2™ with Sherwood's advanced hi-flow first stage for superior performance. Why settle for a regulator that leaves you parched? Get quenched with the Oasis 2™, available only at authorized Sherwood dealers.

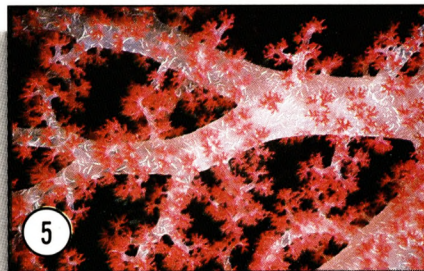
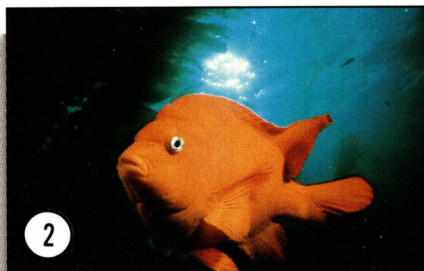
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Product Information 4

SHERWOOD



What does it take to prove that Motormarine II gives you the same great quality photos as the most expensive underwater camera? How about \$10,000.

Nothing shoots better under water.

As far as we can see, there's no difference at all between photos taken with a Motormarine II and its more expensive rival. The quality is identical.

We specialize in underwater camera systems.

And we're so good at it that divers who own other cameras often buy our lenses, extension tubes and strobes to get more for less.

Motormarine II is a total package.

You can't get a more carefully thought out camera system, even at twice the price. It has all the most important features built right in:

■ Close-up lens ■ Exposure automation with TTL flash capability ■ Superb optical engineering ■ Auto wind/rewind ■ DX film coding ■ Water & sand protection

Options include two electronic strobe units, macro lens, wide and super-wide lenses, framer, and parallax adjustable view finder.

Switch instantly from distance to as close as 18 inches, or shoot as close as 3 inches from a subject with lenses you can add underwater. Motormarine II is always ready for once-in-a-lifetime shots, like the ones you see here.

So look closely. If you can guess which photos were taken with the professional Motormarine II and which were taken with the more expensive camera, a \$10,000 check may be waiting for you. One lucky entry will be drawn on May 16, 1994. It could be yours.

FILL OUT AND MAIL TO: Sea & Sea Sweepstakes, 125 Schmitt Boulevard, Farmingdale, NY 11735

OFFICIAL ENTRY FORM

For a chance to win \$10,000, put a check mark under the camera that took each shot. The winner will be drawn from entries having all six correct answers.

Photo	Motormarine II	Other	Name _____
1.	_____	_____	Address _____
2.	_____	_____	
3.	_____	_____	City _____ State _____
4.	_____	_____	Zip _____ Phone () _____
5.	_____	_____	
6.	_____	_____	

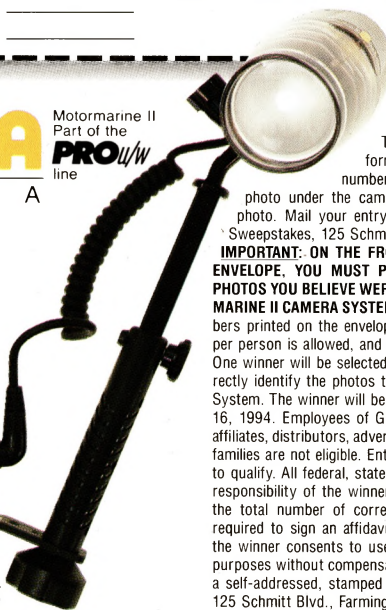
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A Motormarine II Camera shot some of the photos seen above. Which ones? It's worth \$10,000 to one person who gets it right.
Product Information 61



RULES—NO PURCHASE NECESSARY

To enter, complete this official entry form with your name, address, telephone number, and place a check mark for each photo under the camera you think was used to take that photo. Mail your entry form in an envelope to: Sea & Sea Sweepstakes, 125 Schmitt Boulevard, Farmingdale, NY 11735. **IMPORTANT: ON THE FRONT BOTTOM-LEFT CORNER OF THE ENVELOPE, YOU MUST PRINT THE NUMBERS OF ONLY THE PHOTOS YOU BELIEVE WERE TAKEN USING A SEA & SEA MOTORMARINE II CAMERA SYSTEM.** Entries received without these numbers printed on the envelope will be disqualified. Only one entry per person is allowed, and each entry must be mailed separately. One winner will be selected from among those entries which correctly identify the photos taken with the Motormarine II Camera System. The winner will be selected in a random drawing on May 16, 1994. Employees of GMI Photographic Inc., Sea & Sea, its affiliates, distributors, advertising and promotion agencies and their families are not eligible. Entries must be received by May 2, 1994 to qualify. All federal, state and local taxes on prizes are the sole responsibility of the winner. Odds of winning are determined by the total number of correct entries received. Winners may be required to sign an affidavit of eligibility. By accepting the prize, the winner consents to use of name or likeness for promotional purposes without compensation. For the name of the winner, send a self-addressed, stamped envelope to Sea & Sea Sweepstakes, 125 Schmitt Blvd., Farmingdale, NY 11735, by May 2, 1994. The winner will be notified by mail.